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ON

DISEASES

OF THE

SPINE AND OF THE NERVES.

BY

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PUBLISHER'S NOTE.

THIS volume comprises a series of essays, extracted from the "System of Medicine," edited by J. Russell Reynolds, M. D., on a group of diseases of great interest, and many of them of frequent occurrence. These essays are from the pens of gentlemen of acknowledged ability and experience, who have paid particular attention to the several diseases on which they have written. The volume will be found to present the latest advances in the knowledge of the several subjects therein discussed.

PHILADELPHIA, November, 1870.

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DISEASES

OF THE

SPINE AND OF THE NERVES.

I.

DISEASES OF THE SPINAL CORD.

By C. B. Radcliffe, M.D., F.R.C.P.

A. Preliminary Remarks.

Before proceeding to cope with the intricate and difficult pathological topics which form the subject of the present article, it appears to be expedient to glance at some points in the physiology of the spinal cord, and also to try and ascertain the true significance of pain, spasm, and certain symptoms analogous to pain and spasm, which figure conspicuously in the histories of spinal maladies; for if these matters be not disposed of as preliminaries now, they will prove to be the cause of frequent and distracting digressions afterwards.

1. *A glance at some points in the physiology of the spinal cord.*—The result of recent researches has been to establish in the fullest manner the truth of Sir Charles Bell's great discovery, that the posterior roots of the spinal nerves are devoted to sensation only, and the anterior roots to motion only. In one article, at least, the creed of to-day is the same as that of yesterday: and it is some comfort to have it so, for in many other articles faith is not a little shaken by the changes of belief which are now found to be necessary.

The view once held that the posterior columns of the spinal cord are made up of bundles of fibres passing from the posterior roots of the spinal nerves to the sensorium has proved to be untenable. Transverse division of these columns produces in the parts behind the section, *not* numbness, as it would do if these columns were simply the continuation of the posterior roots of the spinal nerves, but hyperæsthesia; and the pain resulting from the section is found to be due, not to any sensitiveness in the columns themselves, but to the irritation having extended to the posterior roots of the spinal nerves. Transverse division of these columns produces in the parts behind the section, not paralysis, but loss of co-ordinating power, such as is seen in locomotor ataxy. Moreover, the researches of Mr. Lockhart Clarke prove very clearly that the filaments, comparatively few in number, which go from the posterior roots of the spinal nerves to the posterior columns of the cord, do not end in those columns, but pass, through them to the part to which the other and more numerous filaments composing the roots pass directly—that is, to the central gray matter of the cord; and thus it is not difficult to see why the posterior columns can be cut across without benumbing the parts behind the section—why a result should follow which would not be possible if those columns were the continuation of the posterior roots of the spinal cord.

All that has been said of the posterior columns of the cord appears to apply equally to the restiform bodies—to the bodies which form the chief connection between these columns and the cerebellum, and not to those bodies only, but also to the small posterior pyramids of the medulla oblongata, which pyramids lie between the restiform bodies posteriorly. The connection between the cerebellum and the posterior columns of the spinal cord, which is made by means of the restiform bodies, is indeed such as to make it not improbable that the posterior columns perform for the cerebellum a similar office to that which is performed for the cerebrum by the anterior columns, or, in other words, that the posterior columns do for the involuntary movements of co ordination what appears to be done for voluntary movements by the anterior columns.

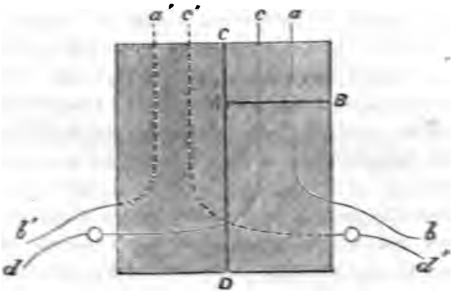
The anterior columns of the spinal cord have, without doubt, a special connection with the anterior roots of the spinal nerves, and an all-important part to play in voluntary movement; and yet this cannot be said of them, as was formerly supposed, in every part of their course. The power of voluntary movement on the same side of the body, in the muscles behind the section, is altogether destroyed when one of the anterior columns is cut across, unless the cut be in the part which lies immediately below the anterior pyramid of the medulla oblongata; and the same result happens when the adjoining lateral column is cut across where it lies side by side with that part of the anterior column which may be cut across without giving rise to paralysis. It is plain, in fact, that in the uppermost part of their course the anterior columns have not that intimate connection with the anterior roots of the spinal nerves, and that all-important part to play in voluntary movement, which they evidently have everywhere else. And it is also plain that the anterior columns have somewhat to do with sensation as well as with voluntary motion, for it is a fact that a certain degree of numbness is always produced by the injuries which give rise to paralysis.

A transverse section of one of the anterior pyramids of the medulla oblongata in any part of its course annihilates all power of voluntary movement in the muscles behind the section on the opposite side of the body; and thus it is plain, not only that each pyramid contains very many, if not all, the conductors concerned in carrying the orders of the will to the muscles of the opposite side of the body, but also that the conductors which are collected in one pyramid decussate with those collected in the other pyramid at the lower and not at the upper boundaries of the pyramids. If anæsthesia be the result of cutting across the anterior pyramids of the medulla oblongata, its amount is too small to be unequivocal; and, in a word, all the evidence, old and new, goes to show that these bodies are composed of conductors concerned in voluntary motion without any admixture of sensory conductors.

The office of the lateral columns of the spinal cord is not so clearly made out as that of the posterior and anterior columns. In the cervical region, for a short distance below the point at which the anterior pyramids of the medulla oblongata intercross, the lateral columns of the spinal cord have certainly very much to do in transmitting the orders of the will to the muscles; for, as has just been seen incidentally, the muscles behind the section on the same side of the body are paralyzed by cutting one of them across. In the lower part of the cervical region, and in the dorsal and lumbar regions, it is very different, and the difference is not very clearly determined. Here some trifling paralysis may be produced by dividing these columns transversely, but never more than this. Here, indeed, it would seem that this operation is followed by a certain degree of anæsthesia, and by the same result, as regards movement, as that which follows transverse division of the posterior columns—that is, not by paralysis, but by in-coördination. A certain degree of anæsthesia appears to be a constant consequence of cutting across the lateral columns in any part of their course; and herein would seem to be an important distinction between the lateral and the posterior columns, for, as has been stated already, the result of cutting across the posterior columns is to produce hyperæsthesia, not anæsthesia.

A section of the olivary bodies is followed, not by any marked degree of paralysis, or anæsthesia, but by a state of persistent spasm in many muscles on the *same* side of the body, in the neck especially—a state which may sometimes continue for days, weeks, or even months. It is found, also, that this strange result is produced by irritating several parts of the base of the encephalon, the lateral and posterior parts of the medulla oblongata and pons Varolii especially, as well as by irritating the olivary bodies. These parts are not very clearly defined. "They seem," says Dr. Brown-Séquard, "to be quite different from those employed in the transmission of sensitive impressions, or of the orders of the will to the muscles, at least in the medulla oblongata and pons Varolii. They constitute a very large portion of these two organs, and, perhaps, as much as three-fourths of the one first named. They are placed chiefly in the lateral and posterior columns of these organs; and because many of their fibres do not decussate, the spasm produced by irritating them is on the *same* side of the body."

Instead of being merely a nerve centre—the special centre of Marshall Hall's excito-motor system of nerves—there is now reason to believe (as Dr. Brown-Séquard has so clearly shown), that the gray substance of the spinal cord is an important conductor of sensory and motor impressions. Paralysis without loss of sensation on the same side of the body, loss of sensation without paralysis on the other side of the body, are the strange results of cutting across one lateral half of the gray substance of the spinal cord: anæsthesia on both sides of the body, paralysis on neither side, are the equally strange results of making a vertical section midway between the two lateral halves: these are the two great facts which, when properly interpreted, furnish the reasons for believing, not only that there are sensorial and volitional conductors in the gray substance of the cord, but also that these two forms of conductors follow a different and definite course. Nor is it difficult to see how this may be. Let the course of the conductors in connection with the anterior and posterior roots of a pair of spinal nerves be what is represented in the following diagram—a b being the motor conductor descending to the right, and a' b' the corresponding conductor descending to the left; c d being the sensory conductor ascending from the left, and c' d' the corresponding conductor ascending from the right—and very little reflection will serve to supply the demonstration wanting. With the sensory and motor conductors arranged in this manner, it is plain that a cut across the right lateral half of the gray substance—a lesion indicated in the diagram by the line A B—must destroy the continuity of the motor conductor a b, and of the sensory conductor c d, and leave untouched the motor conductor a' b', and the sensory conductor c' d'—must bring about, that is to say, what has been seen to happen in the first of the two experiments under consideration; namely, preservation of sensation with loss of motion on the side of the lesion, and preservation of motion with loss of sensation on the opposite side. Again, with the sensory and motor conductors arranged in this manner, it is plain that a longitudinal section of the gray substance of the cord midway between the two lateral halves—a lesion indicated in the diagram by the line C A D—must leave the motor conductors a b and a' b' untouched, and cut across the sensory conductors c d and c' d' at their point of decussation—must bring about what happens in the second of these two experiments, viz., numbness on both sides of the body, and paralysis on neither side.



In saying that paralysis without loss of sensation, on the same side of the body, and loss of sensation without paralysis, on the other side of the body, is produced by cutting across a lateral half of the spinal cord, all is not said that has to be said. In such a case there is, in addition, increased temperature and sensibility on the side on which sensation is preserved, and diminished temperature on the side on

which sensation is lost, especially if the se
the medulla oblongata. It would seem, i
acted on the vaso-motor nerves contained i
the common motor and sensory nerves, causi
nerves on the side on which there is increas
bility, and irritation of vaso-motor nerves o
is diminished temperature and anæsthesia.
explanation is neither impossible nor improb
of Professor Claude Bernard, Dr. Brown-Séqu
upon the cervical sympathetic, prove that when this nerve is paralyzed by dividing it, a state of hyperæmia, of which the most conspicuous signs are a bloodshot state of the conjunctiva and of the lining membrane of the nostril and ear, with a contracted pupil, and with increased temperature, is at once set up on the same side of the head: and also that when the end of the divided nerve which is separated from the cord is irritated, the immediate result is dilatation of the pupil, with an almost complete blanching and cooling of the parts which were bloodshot and warm a moment before. The vessels in these parts evidently relax and receive more blood when their nerves are paralyzed, and contract and receive less blood where their nerves are irritated; and the increased temperature and sensibility which happens in the one case, and the diminished temperature and sensibility which happens in the other case, are nothing more than the natural consequences of the increased or diminished quantity of blood in the parts in each case respectively. All this is plain enough. Moreover, there are other facts which go to show that phenomena in every way analogous to those which result from paralysis or irritation of the cervical sympathetic are produced by paralyzing or irritating the vaso-motor nerves in other parts. There is, therefore, no reason why it may not be inferred that the increased temperature and sensibility of one side of the body, and the diminished temperature of the other side, which happen when a lateral half of the spinal cord is cut across, are the result of vaso-motor nerves being paralyzed in the one case and irritated in the other case. Nay, such an assumption is well-nigh inevitable, for the structural connection between the spinal and sympathetic systems of nerves is such as to make it scarcely possible to believe that a lateral half of the cord can be cut across without paralyzing and irritating vaso-motor nerves.

Above and below the decussation of the anterior pyramids of the medulla oblongata the conductors which have to do with sensation and voluntary motion are arranged differently in the spinal cord. Above this point, the sensorial and volitional conductors belonging to one side of the body lie together in the same lateral half of the cord, and this half is that which appears to belong, not to the same side of the body, but to the opposite side; at this point, the volitional conductors separate from the sensorial and pursue a different course to what is the common destination of both conductors alike, the volitional conductors crossing over at once and in a body to the other side of the cord and passing down this side until each one reaches the particular anterior root at which it emerges, the sensorial conductors passing down the same side of the cord and not crossing over to the of the same (where they rejoin the volitional conductors) until they there at the level of the particular posterior roots with which they are connected. In other words, the sensorial and volitional conductors of the two sides of the body decussate, both of them, in the spinal cord, but not in the same place, the decussation of the volitional conductors being confined to the narrow path where the anterior pyramids of the medulla oblongata intercross, the decussation of the sensorial conductors being all along the spinal cord from one end to the other. Higher up or lower down than the narrow path which has been indicated, there appears to be no intercrossing whatever of volitional conductors.

All the forms of sensorial conductors—those which take cognizance of touch, pain, tickling, temperature, and the rest—appear to follow the same course in the cord, those of the two sides decussating along the whole length of the cord at the level of their entrance or thereabouts, and ascending to the sensorium in the opposite half of the cord to that into which they first pass from the posterior roots; but all the forms of motor conductors do not follow the course of the volitional conductors. Below the point where the anterior pyramids of the medulla oblongata decussate, all forms of motor conductors alike seem to agree in not decussating: at this point, the only motor conductors which decussate would seem to be the volitional. Thus, the increased temperature and sensibility resulting from paralysis of vaso-motor nerves, which is produced by cutting into one side of the medulla oblongata, above the decussation of the anterior pyramids, and the persistent spasm which follows irritation of the corpus olivare and the neighbouring parts—which spasm points to the presence there of motor conductors whose function is not yet clearly determined—are on the *same* side of the body, and not on the opposite side, as they would be if these two kinds of motor conductors decussated like the volitional conductors.

When the continuity of the cord as a conductor is entirely interrupted by being cut, torn, compressed, or injured in any other way, voluntary movement and sensation are immediately abolished in the parts behind the injury, and at the same time the paralyzed muscles, especially in the lower extremities, become much more susceptible to reflex action. The increased susceptibility to reflex action is developed immediately, or all but immediately, and it may continue with little change for days, weeks, or even months—a fact which does not appear to be very intelligible on the current view of muscular action, but a fact nevertheless. The higher the seat of injury to the còrd, the higher must be the level to which the paralysis reaches, and (if the respiratory muscles be affected at all) the greater the interference with the breathing, and, as may be easily understood, it is not difficult to form a tolerably correct diagnosis of the locality of the injury by taking these variations into consideration. If the injury be at the upper limit of the sacral region of the cord, the muscles of the bladder and anus will be paralyzed, and so will the muscles of the lower extremities, with the exception of those which are supplied by the anterior crural and obturator nerves (the psoas, iliacus, sartorius, pectineus, adductor longus, a. magnus, a. brevis, obturator externus, vastus externus, v. internus, rectus femoris, &c.), which nerves come off from the second, third, and fourth lumbar pairs of spinal nerves. If the injury be very low down in the sacral canal, the compressor urethræ and the accelerator urinæ, as well as the sphincter ani, will be paralyzed, but not the muscles of the legs; for the nerves of the three muscles, specified by name, come off almost from the extreme end of the cord, and below those which go to form the great sciatic. When the injury to the cord is higher up in the cord, in addition to the loss of voluntary power in the lower extremities and in the bladder and anus, the respiratory muscles will be more or less paralyzed. If the injury be at the upper limit of the lumbar region, the lateral muscular walls of the abdomen will be paralyzed, and so will all the muscles of the lower extremities, and one effect of the paralysis of the abdominal walls will be to compromise greatly the expiratory movements of respiration. If the injury be high enough to paralyze intercostal muscles, inspiration will be interfered with as well as expiration, and the degree of interference will be in proportion to the number of intercostal muscles implicated. If the injury be low down in the cervical region, all the intercostals will be paralyzed, and so will the muscles of the upper extremities, except those of the shoulders, which receive their nerves from higher portions of the cervical region. If the injury be at or above the middle of the cervical region—at or above the level of the fourth cervical pair of spinal nerves—death will at once result from the suspension of all inspiratory movements. In this latter case it is customary to ascribe the stoppage of breathing to paralysis of the nerve which supplies the diaphragm—that is, the phrenic; but this explanation does not go far enough. The injury which paralyzes the diaphragm paralyzes the scaleni, the intercostales, and the serrati magni, which muscles elevate the ribs in ordinary respiration, and in so doing play a part which is scarcely less important than that played by the diaphragm; and not only so, but it paralyzes also the greater number of those accessory respiratory muscles which, acting upon and from the shoulders, come to the rescue when a great effort at inspiration is necessary, and produce additional expansion in the upper part of the chest. Not only is there a great difference between calm respiration and forced respiration, but there is a great difference also between the respiration of males and that of females. "In males," says Dr. Hutchinson, "the abdomen first bulges outwards, and the ribs and sternum nearest to the abdomen quickly follow this movement, until the motion, like a wave, is lost over the thoracic region. In females the breathing commences with a gentle heaving of the upper part of the thorax, more or less apparent according to the fulness of the mammæ, and with some slight elevation of the shoulders; and this movement of expansion spreads from rib to rib in a downward direction, and any bulging of the abdomen from the descent of the diaphragm is distinctly after this heaving of the lateral walls of the chest, not before it." In females also this bulging of the abdomen is so inconsiderable that the number of respirations cannot be counted by the hand resting on that region as it can be in the male. In calm breathing, in fact, the diaphragm does more and the ribs do less in males than in females, and this difference is so real that, for the sake of distinction, calm breathing may be spoken of as diaphragmatic in males, and as costal in females. This difference, indeed, is such that respiratory movements which are healthy in women are morbid in men; and *vice versâ*, that movements which are healthy in men are morbid in women. "In forced breathing," Dr. Hutchinson again says, "the greatest enlargement of the thoracic cavity in both sexes is made by the ribs and not by the diaphragm, as is generally believed;" and that this statement expresses what really happens, appears to be evident in the fact that in such breathing the hollow at the pit of the stomach, instead of being filled out and protruded, as it must be if the diaphragm descended in any marked degree, is actually drawn in and depressed. In forced breathing, indeed, the costal inspiration of women becomes more costal, and the diaphragmatic inspiration of men changes from this form to the costal. It is certain, however, that there may be forced diaphragmatic breathing as well as forced costal breathing, and that the one may be made to take the place of the other by an easy effort of the will, or by changes of position which interfere with the action of the diaphragm on the one hand, or of the ribs on the other. There is, indeed, no difficulty in understanding why diseases which interfere with the action of the diaphragm or ribs should make the breathing costal or diaphragmatic, as the case may be. As regards the expiratory movements of respiration there is little to say. In tranquil breathing, in males and in females alike, expiration is performed by the relaxation of the diaphragm allowing the abdominal viscera to press up into the position from which they had been depressed in inspiration by the contraction of this muscle, by the relaxation of the costal muscles allowing the ribs to spring back into the position from which they had been pulled up in inspiration by the contraction of these muscles, and by the resiliency of the air-passages themselves. In forced expiration the lateral and inferior muscular walls of the abdomen will help to empty the chest by pulling down the ribs and by contracting upon the abdominal viscera, so as to cause them to push up the diaphragm more effectually. It is easy, indeed, to see how a lesion of the spinal cord which paralyzes the lateral and inferior abdominal walls must interfere with the movements of expiration, and especially with such violent movements as coughing or sneezing. In a word, the whole case of the respiratory movements is one which makes it impossible to continue in the belief that the one reason why the division of the cord at or above the origin of the phrenic nerve proves fatal, is because the diaphragm is paralyzed; for the plain fact is, that the injury which paralyzes the diaphragm paralyzes the muscles which elevate the ribs, both ordinary and extraordinary, and so puts an end to movements which are quite as important as those of the diaphragm, if not more so, in carrying on respiration. Of the other phenomena which may be present when the injury which interrupts the continuity of the cord as a conductor is in the neck, but not so high as to destroy life immediately, and which are not likely to be present when the injury is much below the cervical region, difficulty of swallowing, difficulty in vocalization, contraction of pupils, palpitation, and priapism appear to be the most important.

In these remarks the name of Dr. Brown-Séquard has been mentioned more than once, and it might have been mentioned oftener very easily. Indeed, it is not too much to say that the discoveries of this very distinguished physiologist mark a new epoch in the physiology and pathology of the spinal cord.

2. *On the practical significanse of pain and spasm, and of certain other symptoms more or less akin to pain and spasm.*—Have these symptoms to do with inflammation, or with a state which, though not unfrequently passing into inflammation, is in reality diametrically opposed to inflammation? This is the question to which I propose now to seek the answer, first, in relation to pain and the symptoms akin to pain, and, secondly, in relation to spasm and the symptoms akin to spasm.

(*a*) *On the practical significance of pain and the symptoms akin to pain.*—There are some points in the history of common neuralgia—the beginning and ending of the paroxysm periodically at a given time, the association of the pain with rigors, the frequent ending of the pain in an obscure fit of feverishness, and others—which are calculated to suggest some relationship between this disorder and ague. It would seem, indeed, especially in that form of neuralgia which is met with in agueish districts, as if the neuralgia and the rigors were companion symptoms—as if there was some connection between the pain and a depressed state of the circulation, such as is met with in the cold stage of ague. There is also some reason to believe that neuralgia is antagonized rather than favoured by inflammation and fever. It is no uncommon thing for the history of facial neuralgia or tic douloureux to be this: first, neuralgia, without local tenderness and swelling, and redness, and with frequent chills and shivers, and a decidedly depressed state of the circulation; afterwards, cessation of neuralgia, cessation of chills and shivers, with local tenderness, redness, and swelling, and with some slight feverish reaction. What I have experienced in my own person, as well as what I have witnessed in others, enables me to speak with all confidence upon this point. It is also the rule, rather than the exception, for the *neuralgic* pain of toothache to come to an end when the face becomes swollen and inflamed; and it does not seem to be otherwise with the stabbing neuralgic pains which so generally precede the inflammatory eruption of herpes, for it is usual for these pains to subside concurrently with the development of the eruption. Nay, I know of several cases of sciatica, in which the relief to the neuralgic pain was coincident with the development of a tenderness which seemed to betoken neuritis at one or more points in the course of the painful nerve, and in which, after this change, the patient was comparatively free from pain so long as the lame limb was kept still and let alone. With respect to neuralgia, in all its manifold forms, indeed one thing is certain, and this is, not only that neuritis is not necessary to its production, but also that this form of inflammation is at most a very exceptional complication.

Nor is a different conclusion to be drawn from the history of rheumatic and gouty pain.

In acute rheumatism it is generally found that the pains which had been torturing the patient for days, or weeks, or months previously, preventing him from being at ease in the daytime, and causing him to toss about in sleepless misery at night, come to an end when the feverish reaction and local inflammation of the fully-formed disorder make their appearance. After this, the joints are *tender* enough; but if the patient keep as still as he is very likely to do under the circumstances, he is comparatively or actually at ease so far as his old rheumatic pains are concerned. Or, if it be otherwise, the pains will generally be found to be in a part in which the signs of rheumatic inflammations are imperfectly established or absent, or else at a time when there is a decided remission in the feverish reaction—an event which happens more frequently in this disorder than is commonly supposed.

And certainly it is simply impossible to look upon the local inflammation of gout as essential to the racking pain of this disorder. "About two o'clock in the morning," says Sydenham, who knew full well from personal experience what he ought to say, "the patient is awakened by a severe pain in the great toe, or more rarely, in the heel, ankle, or instep. The pain is like that of dislocation, and yet the parts feel as if cold water were being poured over them. Then follow chills and shiverings, and a little fever. The pain, which was at first moderate, becomes more intense; and with its intensity the chills and shivers increase." After tossing about in agony for four or five hours, often till near daybreak, the patient suddenly finds relief, and falls asleep. Before falling asleep, the only visible change in the tortured part is some swelling in the veins; on waking in the morning the part has become swollen, shining, red, tender beyond measure, and more or less painful, but painful only to a degree which is as nothing in comparison with the torture of the night past. It seems, indeed, as if the pain which now exists may in great measure be referred to the mere tension and stretching of the inflamed ligaments, for it may be relieved, or even removed, by judiciously applying support to the toe and sole of the foot. On the night following, and not unfrequently for the next three or four nights, the sharp pain may return, reappearing and disappearing suddenly, or almost suddenly, and resulting in the development of additional inflammatory swelling in the interval between falling asleep and waking in the morning. The pain in these relapses, like the pain in the first attack, is accompanied by chills and shivers, and by the most distressing irritability and excitability; but, until unequivocal signs of inflammation are developed in it, the painful part is not tender in the true sense of the word. The inflammation, moreover, is attended by no fever, or by very little; or if it be otherwise, as it is occasionally, the inflammation runs higher than usual, *and the characteristic pain is less urgent than usual.* Dr. Garrod points out this latter fact in his excellent work on gout. From its history, then, it would seem as if the pain went hand in hand with the rigors which belong to the cold stage of gouty inflammation. It would seem as if the inflammation, as inflammation, had little to do with the pain; for if it were otherwise it is scarcely to be supposed that the pain should be least urgent in the cases of gout in which the inflammation is most marked, and that the unequivocal signs of inflammation should make their appearance during sleep without waking the patient. Nay, it would even seem as if the pain were put an end to by the establishment of inflammation—as if, in fact, the pains were antagonized rather than favoured by the inflammatory condition. Moreover, the suddenness with which it begins and ends in the majority of cases must be looked upon as a reason for referring the pain to the category of neuralgia—a disorder with which, as I have already shown, inflammation has no necessary connection.

There is also reason to believe that pain holds the same relation to fever and inflammation in other kinds of fever besides the rheumatic, and in other kinds of inflammation besides the gouty.

The pain in the back, often very severe, which ushers in smallpox, disappears before the hot stage is fully established. It comes and goes hand in hand with the rigors, and it belongs to the cold stage as evidently as do the rigors. And this would seem to be the case also in other fevers; for it is the rule, and not the exception, for the pains which attend upon the onset of these disorders to pass away or to become greatly mitigated as soon as the cold stage gives place to the hot. Nay, it would seem as if pain gave place for the time to what may be called artificial feverishness. At any rate, I have more than once felt tic douloureux in my face pass away as soon as I could set my blood in brisk motion by violent bodily exercise; and on two occasions I have put a stop to a sudden attack of lumbago while in the saddle, by a practice which is not unfrequently adopted in such a case in the hunting-field—that is, by leaning forwards, and beating the loins with the hands until the whole body was aglow, and the perspiration dropped from the forehead.

The acute pain of a dislocation or sprain—the pain to which Sydenham likens that of gout—does not, as a rule, remain after the parts have begun to be hot and tender and swollen; and as a rule, also, the pain of idiopathic inflammation goes before, and not along with, the redness and heat and swelling. In the idiopathic, as well as in the traumatic forms of inflammation, it would seem, indeed, as if the pain were related to the cold stage of the disorder, and not to the hot. Nor is a contrary conclusion to be drawn from the history of those cases in which the pain continues after the hot stage of the inflammation is fully established, for in these cases this persistent pain is evidently (in great measure at least) due to the stretching of parts made tender by the inflammation. Thus, for example, the pain which remains after the hot stage is fully established in orchitis and pleuritis, is at once removed or relieved by means which obviate this stretching—in the former case by the free use of the knife, in the latter case by the application of a roller around the chest, so as to prevent the movement of the ribs over the seat of inflammation.

Even in inflammation of the membranes of the brain, severe pain in the head cannot be looked upon as a symptom of this inflammation.

Three or four years ago I had a youth in the Westminster Hospital with well-marked symptoms of acute cerebral meningitis. When I first saw him, he complained of frequent rigors and of a constant agonizing pain in the head, and at this time his face was pale and perspiring, his ears and his head generally were below the natural temperature, his pupils somewhat dilated, and his pulse contracted and feeble. Eight hours afterwards, when I saw him the second time, his face was flushed, his head burning hot, his pupils contracted, his eyes ferrety, his skin hot and dry, his pulse strong and full, and fierce delirium had taken the place of the pain. And this, so far as my experience goes, is the regular history of pain in this disorder. It is pain ceasing, not pain beginning, as the symptoms of active determination of blood to the brain make their appearance. It is pain in association with an anæmic rather than with a hyperæmic condition.

For these among many reasons it is that pain (with the exception of that form of pain which is dependent on tenderness, and which is accidental only) does not appear to be a symptom of inflammation or fever. In inflammation or fever the pain would seem to be connected with the cold stage preceding the hot stage, and not with the hot stage itself—with a state of capillary contraction and deficiency of blood, and not with a state of capillary relaxation and excess of blood—with a state of vaso-motor irritation, and not with a state of vaso-motor paralysis: in other cases, the pain would seem to have to do with a state of circulation which is in reality closely akin to that which exists in the cold stage of inflammation and fever. Pain, however, must not be regarded as a symptom of inflammation or fever because it happens to be associated with the so-called cold stage of these disorders. In point of fact, this so-called cold stage of inflammation or fever is a state which is diametrically opposed to the so-called hot stage. In this cold stage, the vaso-motor nerves (and not these nerves only) are in a state of irritation, and, as the result of this irritation, the capillaries are contracted and bloodless; in the hot stage, on the contrary, the vaso-motor nerves are paralyzed, and, as a result of this paralysis, the capillaries are relaxed and bloodshot. Instead of being stages in the same process, the so-called cold stage and the so-called hot stage are conditions diametrically opposed to each other. Instead of being stages in the same process, it would rather seem that the hot stage has a remedial relation to the cold stage—that, within certain limits, the hot stage is the salutary refluence of a tide of life which has ebbed too low in the cold stage. It is not difficult to see that there is an intimate connection between the so-called cold stage and the so-called hot stage, and that the first may easily change into the second. It is not difficult to see that there must be this relation between these stages; for if, as there is good reason to believe, irritation of vaso-motor nerves may bring about the cold stage by causing contraction of vessels, it is easy to understand that the paralysis of vaso-motor nerves, which follows when this irritation is carried beyond a certain point, may lead to the hot stage by causing relaxation of vessels. At any rate, be this as it may, the plain fact would seem to be that pain, with the exception of that form of pain which is dependent on tenderness, is a symptom belonging to the so-called cold stage of inflammation and fever, or to a state of circulation closely akin to it, and not to the hot stage of inflammation and fever, or to a state of circulation akin to it. Nay, it may even be supposed, and not without some show of reason, that pain *must* be associated with contracted and empty capillaries; for, the sympathies of the nervous system being what they are, it is not easy to believe that the vaso-motor nerves do not participate in the irritation which acts on the sensory nerves, and which, so acting, gives rise to pain.

And if this be so—and this is the practical conclusion to which these remarks tend—it follows that pain is likely to be relieved by measures which are calculated to rouse the circulation and increase the quantity of blood in the capillaries of the principal part, and not by those which have a contrary action.

With regard to tingling and other symptoms which are more or less akin to pain there is little to say. Indeed, all I can say is that the history of these symptoms, so far as it is known to me, would seem to agree rather than to disagree with that of pain, in connecting them with a state of irritation, and not with a state of actual inflammation.

(*b*) *Of the significance of spasm and the symptoms akin to spasm.*—The violent and general epileptic form of convulsion which attends upon death by hemorrhage or suffocation is associated with a defective and not with an excessive supply of arterial blood to one or other of the great nerve-centres. Nor is it otherwise with ordinary epileptic or epileptiform convulsion. The deathly paleness of the countenance which precedes the convulsion is, indeed, a plain proof that the fit commences in a state of circulation which is the very opposite to that of active determination of blood to the head, and the strong pulse which is usually perceptible in the arteries as the fit progresses is no contradiction to this conclusion. This strong pulse is usually regarded as a sign of arterial excitement—as a proof that more arterial blood is being injected into the arteries at this time, and that, on this account, certain nervous centres are excited to an unwonted degree of activity; but the simple fact is, that the strong pulse which is present under these circumstances derives its strength, not from arterial blood, but from venous. Black blood is being pumped into the arteries at the time, and because black blood moves less readily through the capillaries than red blood, the arteries become distended and the pulse endowed with a counterfeit power. The strong pulse in question is caused by the suffocation which is a part of the fit; it is a pulse of black blood and not of red, as may easily be proved by making an opening into the artery; it is nothing more, in fact, than the natural pulse of suffocation. Hence, the strong pulse of the epileptic or epileptiform paroxysm is no proof that this form of convulsion is connected with an excited condition of the circulation; on the contrary, when rightly read, it points only to the opposite conclusion.

It would seem also that convulsion is not associated with an over-active condition of the circulation, even in those cases in which at first sight it might appear to be so. In the fevers of infancy and early childhood, especially in the exanthematous forms of these disorders, convulsion not unfrequently takes the place occupied by rigor in the fevers of youth and riper years. It occurs in the initial cold stage, or else in the last moments of life, not in the intermediate hot stage. Again in inflammation of the membranes of the brain, convulsion, when it occurs, is connected with the cold stage before the hot stage, or with the cold stage after the hot stage, and never with the hot stage itself. Nay, I am disposed to think that there is something altogether uncongenial between convulsion and a state of febrile reaction in the circulation, for it is a fact not unfrequently verified that fits of common epilepsy are often suspended during the continuance of such reaction.

As indeed I have endeavoured to show at length elsewhere, especially in the lectures which I delivered at the Royal College of Physicians, in London in 1862 (post 8vo. London: Churchill and Sons), the physiology and pathology of muscular action, so far as I can read them, serve only to connect all the varied forms of tremor, convulsion, and spasm, with diminished and not with increased activity of the circulation; and thus the practical significance of spasm and the symptoms akin to spasm would appear to be the same as that of pain and the symptoms akin to pain—namely this, that the measures calculated to afford relief are likely to be those which will rouse the circulation to greater activity and increase the quantity of blood in the capillaries, and not those which have a contrary action.

B. On Diseases of the Spinal Cord.

Under the head of diseases of the spinal cord there is no lack of subjects. As of primary importance may be mentioned spinal meningitis, myelitis, spinal congestion, tetanus, and spinal irritation; as of secondary importance, locomotor ataxy, reflex paraplegia, infantile paralysis, hysterical paralysis, hemorrhage, white softening, induration, atrophy, hypertrophy, tumour, concussion, compression, vertebral caries, spina bifida, &c. I shall take each of these subjects in the order in which it has been enumerated, and, as far as I can, apportion the limited space at my command (very limited for such a purpose) so that there may be room for saying most where most is wanted.

I. Meningitis.

Inflammation of the membranes of the spinal cord is usually associated with inflammation of the substance of the cord (myelitis) or with inflammation of the membranes of the brain, but uncomplicated cases do occur now and then, and with care it is not difficult to discriminate between the symptoms which are essential to spinal meningitis and those which are only accidental.

1. Symptoms.—In order to arrive at a knowledge of the symptoms of spinal meningitis, I will relate as a text one of three cases verified by post-mortem examination which have come under my own notice,

and then proceed to see wherein it agrees with or differs from other cases of the kind. I choose an acute case rather than a chronic one, for it is only in the acute form of the disease that the symptoms are to be defined with certainty.

Case.—A lightly-made, delicate-looking youth, nineteen years of age, a cigar-maker by trade, was admitted into one of my wards in the Westminster Hospital on the 27th December, 1864.

(*a*) When I saw him first—this was on the day after his admission—he complained chiefly of pain in the back and great general weakness and weariness, and expressed his belief that he had got rheumatic fever. He was then sitting by the fireside, and looking very ill. On telling him that he had better lie down, he got up and walked towards his bed, or rather he attempted to do so, for the first step brought on a severe pain in the back and legs, with a feeling of faintness and want of breath, and he would have fallen if assistance had not been at hand. Very soon after lying down he passed about a quart of water without any difficulty.

(*b*) The account he gives of himself is this. A week ago, after being very tired by a long walk, he was seized by shiverings and sharp pain between the shoulders. During the next three days he was feverish and without appetite, but still able to go about and do his work. All this while, he had very little pain, and his nights were not disturbed. On the night of the fourth day from the commencement of the illness he was awakened by violent pain along the whole course of the spine in the groins, and in the right leg. Next day the pain occurred several times in paroxysms, and was accompanied by a good deal of starting and jerking in the legs; and so also on the two days following. On the day before admission to the hospital some difficulty in opening the jaw was experienced, and the paroxysms of pain, and jerking, and starting, had become more frequent and urgent. All this while the bowels and bladder acted properly.

Dec. 28. There is no material change since yesterday—not for the worse, certainly.

29*th.* Last night, after three or four hours' sleep, the patient awoke with very severe pain along the spine and down both legs; and since that time the pain has recurred several times. These attacks are separated by intervals of comparative or complete ease, and instead of the jerks and starts, which went hand in hand with it previously, the pain is now accompanied with stiffness in the muscles of the back and legs. At the present moment (about 2 P.M.) the head is drawn back on the pillow, and considerable pain and stiffness in the neck is caused by moving it. Before making this movement the patient was free from pain and stiffness in this region. Asking him to try to sit up, he attempted to do so, but was stopped at once by a severe paroxysm of pain along the whole length of the spine and down the legs, and by the muscles in the painful parts becoming stiff. The action of the muscles produced in this way arched the body backwards almost as much as in ordinary cases of tetanus, and at the same time pursed up the mouth and eyes, and gave a set expression to the features generally, so that the patient for the time had the appearance of a person considerably older than himself. The pain went off in a few minutes, and soon afterwards the stiffened muscles relaxed. The effort to move one of the legs spontaneously gave rise to sharp pain in the thigh and loins, and the limb became somewhat stiffened in a semi-flexed position, and this state of things did not pass off for several minutes; and passive movement produced the same result. There was no numbness: on the contrary, the condition of the skin as to sensation everywhere, as judged by pricking and pinching and by differences of temperature, was plainly that of slight over-sensitiveness. Pressure along the spinal column failed to detect tenderness anywhere, and the result of applying a sponge wrung out of hot water was equally negative.

In the course of the examination it was evident that any movement of the body, or neck, or legs, active or passive, gave rise to pain and stiffness in the muscles moved; and also that there was little or no pain or stiffness so long as the patient kept quite still. It was evident, in fact, that the muscles were relaxed, except perhaps in the neck, in the intervals between the paroxysms. The poor sufferer was evidently in a great strait, dreading all movement, because he knew full well what the effect of movement would be, and at the same time continually prompted by an intolerable feeling of unrest and fidgetiness to wish to have his position changed in a way which he could not or dared not compass by his own efforts: and it is difficult to avoid the conclusion that the stiffness is, in the main, an instinctive act to prevent the movement which gives rise to the pain, rather than spasm like that which is met with in tetanus. The arms are affected as well as the legs, but not to the same degree. They are weak—so weak that it is not easy to find strength to carry the food to the mouth, the left arm being somewhat the weaker of the two. The left arm also cannot be moved, either actively or passively, without giving rise to pain and rigidity, to pain shooting up between the shoulders, to rigidity flexing the limb somewhat at the elbow, and bending the thumb slightly into the palm: not so the right arm. There is no numbness in either arm, and no very decided over-sensitiveness. Mastication is difficult, and deglutition still more so, apparently from the muscles set in movement becoming stiff in moving. The breathing is shallow and slow: the pulse quick (130) and very wanting in strength: the skin profusely perspiring after a paroxysm, and hot and moist at other times. Thirst is much complained of. The bladder is full, and it cannot now be emptied voluntarily. The urine is acid. The penis is flaccid, and has been so ever since the commencement of the illness. The bowels have not acted. The pupils are equal and natural, and there is no headache or other "head symptom."

30th.—A tolerably good night has been passed, and this afternoon the patient thinks himself a little better.

31st.—There has been a bad night, and much ground has evidently been lost since the last visit. In a paroxysm which is just over, want of breath was experienced rather than pain. Sensation is still somewhat exaggerated everywhere. Urine cannot be passed without the catheter, but the bowels have responded to-day to a dose of castor oil and spirits of turpentine which was administered yesterday. During my visit I had an opportunity of seeing the patient *after* a paroxysm as well as in it, and I quite satisfied myself that the muscular stiffness of the paroxysm soon passed off, and that in the interval between the paroxysms the muscles were relaxed, except perhaps at the back of the neck—with this possible exception, because all along the head remained drawn back to some degree upon the pillow.

Jan. 1, 1865.—The night has been perfectly sleepless, with now and then some trifling lightheadedness. The paroxysms of pain, stiffness, and difficulty of breathing are not so frequent (three hours have passed since the last), but the respiration is certainly shallower and less sufficient, and the pulse more rapid and unsteady. There is the same want of power over the bladder. When I left the ward it was plain enough that the patient was sinking; when I returned two hours later all was over, death having happened in a fit of choking and suffocation caused by attempting to swallow a spoonful of beef-tea with a morsel of bread sopped in it. *In the agony, the patient not only sat up in bed, but got out of bed and stood for a moment with his hands bearing upon the shoulders of the nurse who had been feeding him.* The body was examined after death by my friend and colleague, Dr. Bazire, and the following notes were taken at the time from his dictation:—

"Time, twenty-four hours after death. Weather frosty. Cadaveric rigidity well marked. The muscles of the back dark and highly congested. On cutting through the posterior arches of the vertebræ the vertebral vessels are seen to be gorged with dark fluid blood. There is no effusion of blood outside the meninges in the interior of the canal. The meninges are highly congested throughout the whole length of the canal, but to a considerably greater degree in the region between the scapulæ. In this latter region, in addition to the thickening, opacity, and intense red colour of the dura mater elsewhere, there are streaks in its substance of black coagulated blood. The arachnoid is intensely red, and the pia mater extremely congested in the same region. Beyond it, the dark red colour of the dura mater gradually passes into a lighter shade, and becomes a bright pink near the cauda equina in one direction, and near the medulla oblongata in the other. The arachnoid is whitish again near the cauda equina. There is no effusion of serosity, blood, or pus, either between the meninges or on the surface of the cord; indeed, there seems to be a smaller quantity than usual of cerebro-spinal fluid. The substance of the cord itself looks normal in consistence, colour, and size. The central vessel of the cord is highly congested, and on section of the cord there exudes from the centre fluid black blood in minute drops. The cerebral meninges are normal. The cerebral sinuses are highly congested, and the same appearances of congestion (due probably to the mode of death) are met with in the substance of the brain. The organ itself is normal."

The symptoms of acute spinal meningitis are plainly exhibited in this case, and there need be no difficulty in distinguishing those which are of primary importance from those which are secondary.

As symptoms of primary importance may be enumerated these:

fits of pain along the spine and in the extremities produced by movement; fits of muscular stiffness in the painful parts along with the pain; intervals of comparative or complete freedom from pain and muscular stiffness so long as movement can be avoided; absence of paralysis; some exaltation of sensibility; loss of power over the bladder; partial loss of power over the bowel; absence of spinal tenderness.

Fits of pain along the spine and in the extremities produced by movement.—This pain, as I think, must be regarded as the most prominent symptom in acute spinal meningitis. It may be confined to the region of the spine, but more generally it shoots into the extremities, into the legs especially. As a rule, it does not shoot beltwise round the trunk. It is brought on by any movement of the trunk, and, in great measure at least, it may be prevented by avoiding such movement. It is often brought on also by moving one of the extremities, the pain in this case beginning in the limb, and extending thence to the spine. It seems to depend, in part at least, upon the same cause as the pain of pleurisy, viz., the dragging of an inflamed and therefore exquisitely tender serous membrane, and its character is certainly more like the pain of pleurisy than of rheumatism (to which it has been likened), for it occurs in the same sharp, sudden, breath-stopping catches.

Fits of muscular stiffness in the painful parts along with the pain.—It is usual to regard this stiffness as analogous to the spasm of tetanus: it is necessary, as I believe, to look upon it as expressing an instinctive act of muscular contraction, of which the object is to prevent pain by arresting certain movements which produce pain. The spine and extremities cannot be moved without causing pain: the stiffness prevents the pain by preventing the movement; this would appear to be the true view. This explanation, originally given by M. Dance as applying to the muscular stiffness in a case of acute spinal meningitis observed by him and recorded by M. Ollivier, applies perfectly to the muscular stiffness of the case which has been related as the text, and it applies, as I believe, with the same exactness to all cases of the kind. Indeed, I believe there can be no greater mistake than to confound the stiffness in question with the spasm of tetanus. This will be seen more particularly when speaking of tetanus: and here I will only say that tetanus in its most violent form is constantly present where there are no signs of spinal meningitis, and that, in the few cases in which such signs chance to be met with, it may be supposed that the inflammation is a consequence rather than a cause of the irritation which gives rise to the tetanic spasm—a consequence of the irritation in the vaso-motor nerves having proceeded until it has issued in paralysis of the vaso-motor nerves. Nay, after what has been said in the preliminary remarks, it is not impossible that the spinal meningitis which is occasionally associated with tetanus may have served to counteract the spasm rather than to cause it. At any rate, it is certain that spasm of the spinal muscles is not so marked a phenomenon in acute spinal meningitis as in tetanus, and that it is not to be regarded "comme indiquant positivement la phlegmasie des membranes de la moelle;" and it is, to say the least, highly probable that the muscular stiffness which simulates true tetanic spasm is in great measure an instinctive act of muscular contraction to prevent a movement which produces pain.

Intervals of complete or comparative freedom from pain and muscular stiffness so long as movement can be avoided.—These intervals are sometimes of considerable length, even for days. According to my own experience, indeed, the rule would seem to be that as long as the patient can keep still, so long is he, comparatively at least, free from pain and stiffness—a rule which is very different from that which obtains in tetanus.

Absence of paralysis.—The patient is weak, very weak, and he seems to be paralyzed, but in reality he fears to move because movement brings back the pain. "Les mouvements, qui sont en quelque sorte enchaînés par la douleur, ont moins de force, mais ils ne sont point paralysés." (Ollivier, p. 595.) Let this fear be forgotten, and it is possible not only to sit up, but to get out of bed and stand, as happened in the final agony of the patient whose case I have given. This power of movement has been noticed in several cases, of which one is related by Ollivier, and another referred to; and I believe it would be witnessed in all cases of *uncomplicated* acute spinal meningitis in which the fear of suffering pain from movement was not the one absorbing feeling.

Some exaltation of sensibility.—In the case which I have given there was some exaltation of sensibility as to touch, pain, and differences of temperature, but to no very marked degree; and this would appear to be the rule in cases of the kind. It would seem, indeed, that numbness is a purely accidental symptom, which is never present unless the substance of the cord is implicated in the meningeal inflammation.

Loss of power over the bladder.—In acute spinal meningitis, when the symptoms are fully developed, this particular symptom is scarcely ever absent, if ever. Before this time it may be absent, as it was in the case on which I am commenting; but this absence must certainly be looked upon as the exception rather than the rule. Not unfrequently the inability to empty the bladder is preceded by a state of irritability which makes it necessary to pass water almost incessantly.

Partial loss of power over the bowel.—On this point M. Ollivier makes a remark which is certainly true: "Je ferai remarquer que l'abolition des fonctions de la vessie persiste toujours au même degré depuis le commencement jusqu'à la fin, tandis qu'il n'en est pas de même pour l'intestin, puisqu'il y a assez souvent des garderobes naturelles dans les derniers temps de la maladie." (Vol. ii. p. 601.)

Absence of spinal tenderness.—This absence is certainly a common, if not a constant, feature of acute spinal meningitis. In some chronic cases, no doubt, there may be some local spinal tenderness, but on inquiry these prove to be cases in which the phenomena of spinal irritation are mixed up with those of spinal inflammation—in which the inflammatory affection is complicated with that condition of which, as will appear in due time, local spinal tenderness is the distinctive feature.

These are the points which may be regarded as of primary importance in comparison with those which have still to be considered, namely—absence of marked spasmodic symptoms, difficulty of mastication and deglutition, difficulty of breathing, no increased reflex excitability, no priapism, fits of perspiration, no active inflammatory fever, no marked "head-symptoms."

Absence of marked spasmodic symptoms.—The rigidity which attends upon the paroxysms of pain has been seen to be in the main an instinctive act of muscular contraction to prevent a movement which produces pain, and there appear to be no other symptoms of a spasmodic character which occupy a conspicuous place in the history of spinal meningitis. Or if there be any such symptoms, these are in all probability confined, as were the jerks and starts in the case under consideration, to that early period of the disorder in which it may be supposed that actual meningeal inflammation was not developed—to the so-called cold stage of the disorder probably.

Difficulty of mastication and deglutition.—This difficulty is often absent, and when present it is at most a trifling trouble comparatively. There is no true trismus as in tetanus; there is at most only stiffness which prevents the jaws from opening easily and moving freely. This stiffness, moreover, is late in making its appearance, whereas in tetanus trismus is one of the very first symptoms. In a word, difficulty of mastication and swallowing would seem to occur only in those cases of spinal meningitis in which the higher portions of the cord are implicated.

Difficulty of breathing.—This difficulty is always present in some degree, and especially during a paroxysm of pain and stiffness. In some cases, indeed, the movement of the chest may be actually suspended at this latter time, and death may happen from this cause, as indeed was the case in a patient whom I saw not long ago with Dr. Julius, of Richmond.

No increased reflex excitability.—This is not, perhaps, what might be expected theoretically: but, be the explanation what it may, the fact would seem to be that reflex irritability is not increased in acute spinal meningitis in the way in which it is ordinarily increased in tetanus. So far as I have been able to ascertain there would seem to be no material change in reflex excitability in the meningeal inflammation.

No priapism.—The cases in which erection of the penis would seem to be a symptom appear to be those in which the substance of the cord is affected rather than the membrane—cases too in which the seat of the disease is in the cervical and upper dorsal region rather than in the lumbar region. At any rate, it would seem to be the rule for the penis to be flaccid in uncomplicated cases of acute spinal meningitis.

Fits of perspiration.—As in tetanus these follow a paroxysm almost invariably, especially in the latter stages of its disease. Of this there appears to be sufficient evidence.

No active inflammatory fever.—Thirst is a frequent symptom throughout, and there may be at first some heat of skin, but in the most acute cases there is little or no active sympathetic fever. On the contrary, there is usually, even in the cases which have most claim to be considered as acute, a decided want of febrile reaction from the beginning to the end.

No marked head-symptoms.—In very many cases inflammation of the spinal meninges is only a part of a more general disorder in which the cerebral meninges are also implicated, and, therefore, "head-symptoms," of one kind or other will often enough be mixed up with the spinal symptoms; but in cases like the one under consideration, where the spinal meninges were alone inflamed, "head-symptoms" do not figure at all, or figure only as phenomena of very secondary importance. Upon this point there is no lack of evidence. Where spinal meningitis is chronic in its course its symptoms are often so mixed up with the protean symptoms of spinal irritation (of which more in due time) as only to be detected with great difficulty. It may be suspected that the meninges are affected by inflammation rather than by simple irritation if fits of pain and stiffness are produced by movement in the spine and extremities, and if there be at the same time no spinal tenderness, no paralysis, and no tingling or numbness; and this is all that can be said except this, that this suspicion will gather strength if there be chronic disease in the bones and ligaments of the spine. But it may be questioned whether long-continued contraction of the muscles of one or more of the extremities or of the cervical muscles can be reckoned among these symptoms, for such contraction is certainly common enough in cases where the only condition of disorder in the spinal cord or its membrane is one which, from the sudden way in which it begins and ends, and for other reasons as well, would seem to be one of simple irritation.

2. Post-mortem Appearances.—As Ollivier pointed out, the traces of spinal meningitis after death are met with usually, not in the arachnoid membrane, which is non-vascular, but in the subjacent vascular tissue. The arachnoid is so thin and transparent as to allow the vascular injection produced by the inflammation in the deeper structures to appear through it, and that is all. This injection is generally less evident on the surface of the cord than on that of the dura mater, because in the former place it is hidden by the effusion of turbid, sero-purulent, or purulent fluid in the space between the arachnoid and pia mater—in the space naturally occupied by the rachidian fluid —is hidden by an effusion which, before the arachnoid is opened, often causes the cord to have a swollen, opaque, yellowish-white, or yellowish appearance. Any fluid effusion is usually in this space, but sometimes there may be fluid, in this case often sanguinolent, in the space outside the dura mater, especially if there be disease in the bones or ligaments of the spine. Sometimes the rachidian space is obliterated here and there by inflammatory adhesions; sometimes the surface of the arachnoid is roughened or otherwise altered by calcareous or other deposits in patches: sometimes the opposed surfaces of the arachnoid are more or less adherent; but generally the surfaces of the arachnoid are smooth and free, and the inflammatory products are met with below this membrane, and not above it. Very often, also, the proper signs of spinal meningitis are mixed up with those of cerebral meningitis or

myelitis, or with those of disease in the bones or ligaments of the spine.

3. CAUSES.—The causes of spinal meningitis are often very obscure. In some cases it is rheumatism, or syphilis, or the suppression of some menstrual, hæmorrhoidal, or other habitual discharge, or the spreading of cerebral meningitis downwards, or of disease in the bones and ligaments of the spine inwards, which would seem to figure as a cause; in other cases it is a casual injury to the back, or a chill caught by lying on the back on the cold and damp ground, or some particular disease, as tetanus, chorea, or hydrophobia, to which blame appears to belong. In fact, the causes are legion, and it is impossible to connect spinal meningitis with any particular cause or set of causes.

4. DIAGNOSIS.—One or two points of diagnosis have been mentioned incidentally when dealing with the symptoms of spinal meningitis, and with these it is best to be content at present, for before this matter can be gone into advantageously materials must be had which can only be forthcoming when the phenomena of myelitis, spinal congestion, and other spinal maladies have been passed in review.

5. PROGNOSIS.—Acute spinal meningitis is, without doubt, a very formidable and fatal disease. There are, indeed, few well-authenticated instances of recovery on record, and by some it is doubted whether there be any. Life may be cut short in four or five days, or it may be prolonged to twenty or thirty days, but not often—not often, indeed, beyond six or seven days. In the subacute and chronic forms of the disease, the prognosis is of course less gloomy, but even here it is far from cheering.

6. TREATMENT.—In all cases of spinal meningitis, rest in the recumbent position, more or less strictly enforced according to the urgency or leniency of the symptoms, is indispensable, the best position, perhaps, being not strictly on the back, but rather upon the side, and with the limbs a little lower than the back, so as to favour the draining away of blood from the congested parts, and at the same time, to facilitate the use of the local applications to the spine which may be necessary. Upon this point there can be little or no difference of opinion; upon all other points, in all probability, few will think alike. For my own part, I should be disposed to place most confidence in iodide of potassium and opium, with the local application of ice to the back in acute cases, and to bichloride of mercury, with counter-irritation in one form or other to the spine, in chronic cases. At the same time, I am inclined to think that the present fashion has set very unwarrantably against the old practice of giving calomel and opium, so as to affect the gums slightly and speedily, and of using local, if not general, bleeding in acute inflammatory disease. There can, I think, be little doubt as to the marked influence for good of calomel and opium in acute inflammation of serous membranes; and it would require very little persuasion to induce me to prefer this mode of treatment to that by iodide of potassium in acute spinal meningitis; and, further, I can readily believe that in such a case recovery would

be promoted by a judicious abstraction of blood. I have twice seen symptoms, so closely resembling those of acute spinal meningitis as not to be distinguished from them, disappear coincidently with the occurrence of local hemorrhage, once from piles, once in the form of menstruation; and I can well believe that a similar result might be furthered by the application of leeches around the anus or to the cervix uteri—to these parts rather than to the back, because their vessels would seem to communicate more directly with the deep spinal vessels. It is very probable, however, that the time will soon pass in which depletion in any form, or depressing remedies of any kind, are required, and that the indications will rather be towards brandy, or ammonia, or ether, than towards the remedies which have been mentioned, for all acute diseases of the spinal cord would seem to have a rapidly devitalizing influence upon the system. In acute cases the catheter may be necessary to empty the bladder; in chronic cases, aching and stiffness of the limbs may point to friction and shampooing as likely means of relief. In every case there is sure to be some peculiarity to which attention must be directed if the plan of treatment be all that it ought to be; and, in short, every case must be treated on its own merits.

II. Myelitis.

Myelitis, or inflammation affecting the substance without involving the membranes of the cord, is a well-defined and not very uncommon disease. It may occur in an acute or in a chronic form: it may be general or partial: and, to say the least, its features are quite as well marked and distinctive as those of spinal meningitis.

1. Symptoms.—As an instance of acute myelitis, and as a text for what has to be said under this head, I take the notes of the case of a hospital patient under my care not long ago.

Case.—Charles K., a draper's assistant, twenty-six years of age, unmarried, a patient admitted into the National Hospital for the Paralyzed and Epileptic on the 9th of June, 1864.

(*a*) The chief symptoms complained of are paralysis and anæsthesia below the waist, a disagreeable feeling of tightness around the waist, inability to pass water, involuntary stools, and pain in the left side of the chest. Above the waist, the power of movement and the power of sensation are natural; below the waist, all the voluntary muscles are entirely paralyzed, and the sensibility to pain, to tickling, to differences of temperature, as well as to touch, are completely lost. Pressure along the spine is felt above the point to which the anæsthesia reaches, but not below it, and where felt the patient bears it without wincing. In other words, there is no tenderness on pressure in that part of the spine which preserves its sensibility. The feeling of warmth produced by passing a sponge soaked in moderately hot water along the spine is felt above the point to which the anæsthesia reaches, but not below it, and, where felt, the feeling of heat is natural, except at the line of junction between the sensitive and insensitive parts, and there the feeling produced is that of burning. Moreover, the warm sponge produces the same feeling of burning all around the body in the course of this line of junction, and thus it is plain that this local over-sensitiveness to heat is not confined to the spine. No reflex movements are produced by tickling the soles of the feet. The alæ nasi work very much, the lips are somewhat dusky, the lower intercostal muscles are motionless and the accessory inspiratory muscles are in full work, the air passages (especially on the left side) are loaded with phlegm, the pulse is hurried and weak, the skin is moist and somewhat cooler than natural, and the voice is so low as to be scarcely audible. A cough of the feeblest sort is almost incessant, but the expiratory power at command is altogether insufficient to bring about the expectoration which is so much wanted. All appetite is gone, but food can be taken, and there is no thirst, or none to speak of. The urine, which is acid, and of the specific gravity of 1015, has to be drawn off by the catheter. There is no priapism. A stool has just passed without the patient being aware of it until his nose took account of the accident.

(*b*) A week ago, on awaking from a short nap, the patient found that his toes had gone to sleep, and that he had to "take long breaths." Instead of passing off, the feeling of tingling spread from the toes to the feet, from the feet to the legs, from the legs to the thighs, until it reached the seat, becoming less and less endurable as it spread, and being at last accompanied by a feeling of tightness around the waist and around the left instep, and by a state of restlessness which made it impossible to sit still for more than a moment at a time. After suffering in this way for a couple of hours, an attempt to pass water, which failed altogether, was followed by an almost intolerable uneasiness at the end of the penis, and by a sudden weakness in the legs which make it necessary to remain on the bed upon which he had fallen. Up to this time there had been no difficulty in standing or walking, not even in going up and down stairs. A friend of the patient's now present says: "I saw him on the evening of the day on which he was attacked, a couple of hours or so after he had been obliged to take to his bed. I thought he was suffering from severe rheumatic pains. For some hours those pains were excruciating. I had never before seen any one suffer so much. He tossed about in dreadful agony: he roared out with pain often, and when not roaring, he groaned." Having thus passed seven or eight miserable hours, he fell asleep and slept until breakfast-time next day. Upon waking in the morning he could neither move his legs nor empty his bladder; he had lost all feeling below the waist, and all the miserable feelings which had kept him in a state of continual unrest before he fell asleep were gone. On inquiring whether these feelings were of the character of pain, he says, "No, not exactly, worse than pain, one continued numb stinging feeling, as if the parts were asleep," so that the friend's words which have just been quoted must be taken as meaning not exactly what they seem to mean in this particular. For the six days preceding his admission to the hospital a state of imperfect priapism was apt to come on of itself, or to be brought on by introducing a catheter to draw off the water, and this is the only point remaining to be noticed here, for in other respects the condition seems to have remained stationary, except, perhaps, that a little ground was lost every day.

The patient seems to have come of a healthy family, and, though never very strong, to have himself always enjoyed tolerably good health. He was confined to the house for a few days about two months ago for "influenza," and this is the only illness of any kind he remembers to have had. He says, "I was fatigued by a long walk on the day I was taken ill, and for a month and more I had felt more tired in my back and legs than usual in an evening, and more rheumatic—less up to the mark;" and also, "My back always ached at the end of the day's work, and so did my legs, and I was always glad to go to bed soon, for in bed I was comfortable:" and besides these statements there appears to be nothing at all calculated to throw light upon the history of his present malady.

Jan. 10. Early this morning, after a sleepless night, a severe rigor commenced in the right arm, and then extended first to the back, and afterwards to the whole body. This rigor continued a full quarter of an hour, and was followed by profuse perspiration. During its continuance the paralyzed parts were very cold: after it had ceased the warmth returned, and brought with it a considerable mitigation of the cough and trouble of breathing. Indeed, after the establishment of reaction, difficulty of breathing ceased to be an urgent symptom, except for a moment or two after waking from an occasional and very brief doze. The anæsthesia in the trunk has mounted full an inch higher since yesterday, but it has not extended to either of the upper extremities. Priapism occurs frequently. The pulse is 150, the respirations are 36 in the minute.

11*th.* There has been no sleep in the night. The engorged condition of the lungs has gained headway, and the harassing suffocative cough has returned. Hiccough is frequent and distressing. Once during the day the passage of the catheter was obscurely felt, this being the first sign of feeling in this part since the commencement of the illness. The urine is decidedly acid. The electro-contractility and electro-sensibility of the paralyzed muscles is annihilated.

12*th.* For the last twenty-four hours the increased difficulty of breathing attending sleep has caused the patient to wake immediately if he for a moment forgot himself. "I can't breathe except I keep awake," he said in a voice scarcely audible; and also, "I hope I have not long to live." The passage of the catheter is still obscurely felt, and the escape of flatus and feces is perhaps not so entirely unfelt as it has been since the commencement of the illness. In other parts the anæsthesia, like the paralysis, remains as complete as ever. The urine is still acid, distinctly so. For the last twenty-four hours there has been no priapism, and scarcely any cough. At present hiccough is almost constant, the pulse is fluttering, the hands are cold and clammy, and, in short, the signs of the near approach of death are not to be mistaken.

13*th.* The patient lingered through the night, and died about daybreak; his mind unhappily remaining too clear to the very last.

The notes of the post-mortem examination are as follows:—

14*th*, 4.30 P.M. Rigor mortis is fully established everywhere. The dependent parts present considerable signs of suggillation, especially along the course of the spine, and there is incipient breaking of the skin on both the nates. The arachnoid covering of the cord everywhere is clear, smooth, and without any traces of inflammation. The outside of the lumbar enlargement is curiously nodulated. On making a longitudinal section, the whole substance of the cord, from the brachial enlargement to its inferior extremity, is found to be of a yellowish-red colour, softened in a remarkable manner, and in the lumbar region almost like cream in consistence. Several small patches of extravasated blood are scattered in the softened structure, these patches being undefined in outline, more numerous in the lumbar than in the dorsal region of the cord, and situated chiefly in the posterior columns. The red discoloration which has been mentioned is most marked in the neighbourhood of these patches. The examination did not extend further, the friends of the patient consenting to it only on condition that it should be thus partial.

15*th*. On examining some portions of the diseased cord under the microscope, the natural structure is found to be altogether broken down, and mixed up with blood corpuscles, exudation granules, and (in fewer numbers) pus-corpuscles.

With a view to arrive at a knowledge of the general features of myelitis, I select as the principal points for comment in this particular case the following: Paraplegic anæsthesia, ushered in by tingling or some similar sensation in the parts which eventually became anæsthetic; paraplegic paralysis, ushered in by uncontrollable restlessness; a disagreeable feeling of tightness around the waist and elsewhere; absence of pain in the spine or extremities—of pain produced by movement especially; absence of trismus and other spasmodic or convulsive symptoms; retention of urine; involuntary stools; absence of pain on pressure (spinal tenderness) in any part of the spine; increased sensibility to differences of temperature, by which moderately warm or iced water gave rise to a feeling of burning instead of the natural feeling over the vertebra which marks the upper limit of the myelitis; annihilation of reflex excitability in the paraplegic parts; priapism; acidity of urine; comparative voicelessness; impeded respiration; engorgement of lungs and other viscera; tendency to bed-sores; loss of electro-contractility and electro-sensibility in the paralyzed muscles; absence of "head-symptoms;" absence of fever.

Paraplegic anæsthesia, ushered in by tingling or some similar sensation in the parts which eventually became anæsthetic.—In this case the anæsthesia was developed suddenly during the first night's sleep; it was deep-seated as well as superficial; it implicated the sensibility to pain, tickling, and differences of temperature, as well as that of touch; it had a paraplegic distribution; and this would seem to be the rule in cases of acute myelitis. In chronic cases it is developed more gradually, and it may not extend to all the various forms of sensibility; moreover, it may in some instances be quasi hemiplegic instead of paraplegic; but the rule in acute cases appears to be what it is found to be in this. The anæsthesia seems to be usually ushered in by tingling or by some analogous sensation, disagreeable enough, but not amounting to actual pain. In this particular case the preliminary sensation was not pain, but an unbearable "numb stinging" as if the parts were asleep, with a feeling of tightness around the waist, and around one of the insteps. In acute cases it is right to speak of anæsthesia as ushered in by tingling or some similar sensation, but scarcely so in chronic cases. In chronic cases, indeed, these anomalous sensations may never exactly come to an end, because in these cases the destruction of sensibility may never get beyond numbness—may never reach nearer to anæsthesia, that is to say, than dysæsthesia.

Paraplegic paralysis, ushered in by uncontrollable restlessness.—The paralysis was thus ushered in in the case under consideration, and in two similar cases which have come specially under my own notice—by restlessness, and *not* by any more marked tremulous, convulsive, or spasmodic symptom. Neither does it appear that a different rule obtains in other cases, acute, subacute, or chronic. In the great majority of cases, no doubt, the paralysis has a paraplegic form, but in a few cases it is not so. In the great majority of cases, the paralysis is accompanied by numbness, but not absolutely in all. Sometimes, for example, as in the case in which the paralyzing lesion is limited to a portion of one lateral half of the spinal cord—the case about which enough was said in the preliminary remarks—there is paralysis without numbness on one side, and numbness without paralysis on the other side. Several cases of this kind are on record, and the number of them which I have myself met with is sufficient to convince me that they are scarcely to to be looked upon as out of order and exceptional. Sometimes, also, as in the case where the paralyzing lesion is confined to a portion of one of the anterior columns, the paralysis may be divorced from numbness, and not only so, but it may be hemiplegic in its distribution; and in such a case it may, in fact, be no easy matter to say whether it is dependent upon a cerebral or upon a spinal cause. In some cases, also, the paralyzing lesion may be so localized as to affect only, or chiefly, an arm on one side and a leg on the other side. Usually, however, the paralysis is distinguished by being associated with numbness, and by being paraplegic in its distribution.

A disagreeable feeling of tightness around the waist and elsewhere.—A feeling of circular constriction around the trunk, or around some part of an extremity, around the trunk especially, is so common as to deserve to be considered as an almost constant symptom in myelitis. I do not recall a case, acute or chronic, in which it was entirely absent at all times.

Absence of pain in the spine and extremities—of pain produced by movement more especially.—In chronic cases of myelitis, Dr. Brown-Séquard speaks of "a constant pain in the part of the spine corresponding to the upper limit of the inflammation of the cord" as a characteristic symptom; but I question very much whether this statement is in accordance with well-sifted clinical facts. Pain, either in the spine or elsewhere, is not mentioned, for example, in the nineteen cases, acute or chronic, given by Ollivier, except in three, and of these three the myelitis was complicated with meningitis in two and in the one remaining the symptoms justify the presumption (and there was no post-mortem examination to set it aside) that the same complication existed. At any rate, it is certain that there is not in uncomplicated myelitis that severe pain in the back and limbs which is brought on or aggravated by movement in spinal meningitis.

Absence of spasmodic symptoms.—Ollivier speaks of continuous contraction of the limbs as being met with "assez ordinairement," in chronic myelitis; but the cases cited by this excellent observer do not substantiate this statement. Thus, out of nineteen cases of myelitis, complicated and uncomplicated, acute and chronic, there are three only in which these contractions were present, and not one of the three can be cited correctly as a case of myelitis. In one of the three (No. 87) the sensibility was intact, and the disease of the cord confined almost exclusively to the anterior column; in another (No. 93) there was obtuse sensibility, and the disease was chiefly in the gray matter; and in the third (No. 94) sensibility remained, and there was no post-mortem examination to show what the disease in the cord really was. In each one of these cases, also, there were "head symptoms" which do not figure in uncomplicated myelitis. Again, prolonged contraction of the extremities is a not unfrequent symptom in cases in which there is neither myelitis nor spinal meningitis—cases which properly come under the head of "spinal irritation," and about which more will have to be said in another section of this article. In these cases the contraction, instead of pointing to inflammation of the cord or its membranes, is really no more than one of a series of so-called hysterical phenomena. It is a sign of functional disorder only, and that it is so is evident (these among other proofs) in the sudden and complete way in which it passes off, as well as in the fact that it does not leave behind it any permanent organic traces. It depends as it would seem, upon a state of irritation in some part of that track in which irritation gives rise to prolonged spasm—a state issuing, it may be, now and then in inflammation, but in itself, so far as the condition of the blood-vessels is concerned, diametrically opposed to inflammation. Nay, even in those exceptional cases of myelitis in which there is increased reflex excitability in the paralyzed limbs, it is difficult to connect these spasmodic symptoms with the inflammation. Dr. Brown-Séquard says: "When the dorso-lumbar enlargement is inflamed, reflex movements can hardly be excited in the lower limbs, and frequently it is impossible to excite any. On the contrary, energetic reflex movement can always be excited when the disease is in the middle of the dorsal region, or higher up." And again, when speaking of the reflex convulsions which may happen in the cases where the inflammation is in the middle of the dorsal region or higher up, he says, "Convulsions do not take place at the beginning of the inflammation, but some time after, and they recur by fits for months and years after." And this is precisely what happens. In a word, the truth would seem to be that these reflex spasmodic movements must be referred, *not* to inflammation in the lumbar enlargement of the cord, nor yet to inflammation higher up in the cord; for in this case, to repeat what has just been said, " the convulsions do not take place at the beginning of the inflammation, but some time *after*, and they recur by fits for months and years *after*." They happen, as it would seem, *after* the inflammatory disorganization has interrupted the continuity of the cord, and produced a state of things analogous to that of a guinea-pig, or other animal, whose spinal cord has been cut across experimentally—a state of things of which increased reflex excitability in the paralyzed parts is one of the consequences. Nor is a different conclusion to be drawn from the occasional presence in the paralyzed muscles of a state which is analogous to or identical with the "late rigidity" of Todd. This "late rigidity" is very different to "early rigidity." In "early rigidity" the electro-motility of the muscles is increased, and the muscles relax during sleep, and to a less degree under the influence of warmth. The muscular contraction is evidently of the nature of spasm. In "late rigidity," on the contrary, the muscles are wasted, their electro-motility annihilated, and sleep or warmth do not tell in causing relaxation. This form of muscular contraction, indeed, if not identical with rigor mortis, is, as it would seem, more akin to this state than to spasm. In the case of myelitis which serves as my text, there was none of the painful muscular rigidity produced by movement which is so prominent a symptom in spinal meningitis. There was, indeed, no spasmodic symptom of any kind, with the exception of the rigor which ushered in the extension of the disease on the day after the admission of the patient to the hospital. And this absence of spasmodic symptoms would seem to be the rule in all cases of myelitis, acute or chronic. In children, it is true, myelitis may be ushered in by convulsion—in which case the convulsion manifestly represents the rigor which may usher in myelitis in adults, and as manifestly belongs to the precursory stage of irritation, and not to the state of actual inflammation—but even in children, unless there be some meningeal complication along with the myelitis, this preliminary convulsion would seem to be a rare phenomenon.

Want of control over the bladder.—This appears to be the earliest as well as the most constant of the symptoms of myelitis. It usually depends upon paralysis of the accelerator urinæ and compressor urethræ, but now and then it would seem to be connected, for a while at least, with a state of spasm in the latter of these muscles, in which case the dribbling away of the water or the introduction of a catheter will sometimes produce marked reflex spasms in the legs. I remember one case —a case in which the myelitis seemed to have interrupted the continuity of the cord high up in the back—where an attempt to use the catheter often gave rise to strong reflex spasms in both legs, and to a state of spasm in the urethra strong enough to prevent the passage of the instrument.

Want of control over the rectum.—In myelitis paralysis of the sphincter ani is usually associated with paralysis of the accelerator urinæ and compressor urethræ. Now and then also, the sphincter ani, instead of being paralyzed, may be in a state of reflex spasm: thus, in the case to which I have just referred, the administration of an enema was sometimes rendered impossible by the spasm set up in the sphincter ani and in the femoral muscles by the pipe.

Absence of local spinal tenderness.—As in spinal meningitis, so in myelitis, absence of tenderness on pressure in any part of the spine would seem to be the rule, and not the exception. Ollivier, speaking of pain in the back in myelitis, says, "Elle n'est jamais rendue plus aiguë par la pression," and my own experience in the matter is, without question, to the same effect.

Altered sensibility to heat and cold by which a feeling of burning is felt when a sponge soaked in moderately warm water or a piece of ice is applied to the spine immediately above the seat of inflammation.—Several years ago it was pointed out by Mr. Copeland that, when a sponge soaked in water a little above the temperature of the blood was passed along the spine from above downwards, it gave rise to the natural feeling of heat until it reached the inflamed part, and that then this feeling changed to that of burning; and more recently Dr. Brown-Séquard has shown that a similar result is arrived at by passing a piece of ice down the spine, the natural feeling of cold being felt until the inflamed part is reached, and then an unnatural feeling of burning. In many cases, no doubt, all this would seem to be quite true, but not in all, perhaps not in the majority: and therefore it is impossible to look upon the feeling of burning thus produced as more than an occasional occurrence in myelitis.

Annihilation of reflex excitability.—What has to be said under this head has been anticipated when speaking of the absence of spasmodic symptoms in myelitis. It has indeed been seen to be the rule for all reflex movements to be annihilated or greatly weakened in the paralyzed parts, and that the apparent exceptions to this rule are to be explained, not by referring the increased reflex movement to myelitis, but by supposing the inflammatory disorganization to have interrupted the continuity of the cord and produced a state of things analogous to that of a guinea-pig whose cord has been cut across for experimental purposes.

Diminution of electro-motility and electro-sensibility in the paralyzed muscles.—Except in those few, very few, cases in which the reflex excitability is increased, the electro-motility and electro-sensibility of the paralyzed muscles are invariably diminished in myelitis. Where the reflex excitability is increased the electro-motility may also be increased, and so also may the electro-sensibility, but more generally the increase in the former property is without a corresponding increase in the latter. The paralyzed muscles are wasted in almost all cases, and relaxed also, except in those few cases in which the paralysis has lasted for a very long time and become associated with that state of "late rigidity" which, sooner or later, is always found to seize upon paralyzed muscles. Marshall Hall noticed the impairment of irritability in spinal paralysis, and was of opinion that an opposite state of things existed in cerebral paralysis. As was pointed out by Todd, however, this supposed distinction between spinal and cerebral paralysis does not hold good, the simple fact being that in the great majority of cases of cerebral paralysis the irritability of the paralyzed muscles, instead of being increased, is either not materially altered or else more or less diminished—most generally diminished in a very marked degree. In a word, the investigations of this very accomplished physician show most clearly that in cerebral paralysis the irritability of the paralyzed muscles is only increased in those comparatively few cases in which the paralysis is associated with "early rigidity."

Priapism.—It is difficult to attach any diagnostic value to this symptom. As in acute spinal meningitis, so in acute myelitis, it is sometimes present and sometimes absent, less frequently present in the latter affection perhaps than in the former.

Frequent alkalinity of the urine.—Dr. Brown-Séquard says: "One of the most decisive symptoms in myelitis is alkalinity of the urine. There is no patient attacked with myelitis in the dorsal region of the cord whose urine is not frequently alkaline. At times, especially after certain kinds of food, the urine is acid, but the alkalinity soon returns." And no doubt the urine is very generally alkaline in myelitis, especially in those cases in which the paralysis of the bladder has led to secondary disease of this organ; at the same time, as in the case under consideration, the urine is too often acid to make it possible to insist upon alkalinity of the urine as a necessary feature in myelitis.

Dyspnœa.—Difficulty of breathing was a very urgent symptom in the case which serves as my text, and so it must be in every case where respiratory muscles are so gravely implicated in the paralysis, and where the lungs are so much engorged. Indeed, the usual way in which myelitis proves fatal is by compromising the sufficiency of the respiration. Now and then, especially when chronic inflammation affects the higher regions of the cord, the difficulty of breathing may occur in paroxysms not unlike those of asthma, but usually the difficulty shows itself rather as simple shortness of breath—shows itself in a way which supplies another proof of the absence of the spasmodic element in the history of myelitis.

Want of power in the circulation.—There is little or no sympathetic fever in the most acute form of myelitis; and in the ordinary chronic forms, the feeble pulse, the œdematous condition of the paralyzed extremities, the disposition to passive engorgement in the lungs and elsewhere, and other symptoms of like meaning, show very plainly that the state of the circulation is eminently asthenic. It would even seem as if there were something in the very fact of myelitis which has a positive influence in subtracting power from the circulation—which exercises a devitalizing influence upon the system generally.

A tendency to bed-sores, wasting, and other signs of defective nutrition in the paralyzed parts.—Sooner or later, generally at a very early date, a marked disposition to bed-sores in places where paralyzed parts are subjected to pressure is apt to show itself in myelitis, and so also are other signs of defective nutrition in the same parts, such as œdema, dryness and scurfiness of the skin, and a wasted and flabby state of the muscles. So marked, indeed, is this impairment of nutritive power in these paralyzed parts, that it is only by very great care that bed-sores and the other lesions which have been mentioned can be prevented.

Absence of head symptoms.—In cases where acute myelitis attacks the higher portions of the cord, there may be, and there in all probability will be, various "head symptoms"—vertigo, singing in the ears, grinding of the teeth, delirium, convulsion, coma, or others—but these cases, to say the least, are not common. Whether acute or chronic, indeed, myelitis is much more apt to attack the lower portions of the cord than the upper, in this respect differing from spinal meningitis; and when it attacks the upper portions of the cord, and its symptoms present cerebral complications, the chances are that the case is not simple myelitis, but myelitis with more or less spinal meningitis in addition.

When the cord is affected generally, the symptoms of myelitis will not differ greatly from those which are present in the case which has been given; when the inflammation is more localized, the symptoms will vary accordingly. If, for example, the inflammation be limited, as it usually is, to the lumbar enlargement of the cord, the level of the paralysis and anæsthesia will be proportionably low down; and if the extreme end of the cord only be affected, it is possible that the legs may escape altogether, and the bladder and anus be alone at fault. As indeed the level of the inflammation in the cord falls or rises, so must the level of the paralysis and anæsthesia fall or rise also. Exaggerated reflex movements in the inferior extremities will also (in all probability) be associated with the paralysis and anæsthesia, if the lower parts of the cord be sound and the inflammation confined to a portion of the cord higher up. Again, the symptoms which are present when the inflammation is limited to a part only of the thickness of the cord will be different in many respects from those which are met with when the whole thickness is affected. If, for example, a portion (the upper half-inch of their course excepted) of the anterior columns be affected solely, there would be paralysis without anæsthesia; or if the posterior columns were alone affected, there might be inco-ordination of movement and some hyperæsthesia instead of paralysis and anæsthesia. In short, the variations of symptoms, which occur where myelitis is restricted to particular parts of the cord, can only be properly intelligible to him who has clear notions respecting those physiological matters which were glanced at in the preliminary remarks—which were then glanced at chiefly in order to avoid perplexing physiological digression and discussion in the present place among others. I will, therefore, assume that what was said in the preliminary glance at some points in the physiology of the spinal cord, will serve to explain sufficiently the variations of symptoms which may be expected to exist when the integrity of particular parts of the spinal cord is destroyed by myelitis or in any other way: and, for the rest, I will only say that myelitis may be chronic and subacute as well as acute in its course, and that these several varieties interblend insensibly the one with the other.

2. POST-MORTEM APPEARANCES.—Myelitis may result either in softening or in hardening of the spinal cord. Most frequently the cord is broken down, reduced to a yellowish or reddish cream-like

consistence; the colour, derived from the admixture of pus or blood-corpuscles, being more yellow or more red according as the one or the other of these corpuscles predominate. This softening may affect the whole thickness of the cord, or certain parts more than others, the gray matter especially; it may extend from one end of the cord to the other, or it may be confined to certain regions, in which latter case the part most likely to be affected is the lumbar enlargement; and it would often seem to have its starting-point in the central gray matter, which is the most vascular part of the cord. In the first stage of myelitis this central gray matter has a rosy or vinous tinge, which is not natural to it; it is plainly more vascular than it ought to be; and, in short, it has undergone the very same change which is met with in the gray matter of the brain in encephalitis. Sometimes the spinal cord is considerably swollen, and sometimes the surface may have a nodulated appearance in certain parts, from the membranes having yielded at these points to the blood which may have escaped, or to the pus which may have collected, underneath. Not unfrequently small collections of blood are met with in the softened nerve tissue, especially in the position of the central vessel, so that the first impression upon opening the cord may be that of hemorrhage rather than that of myelitis. One remarkable feature of inflammatory softening, says Dr. Todd, is that "it exhales a marked odour of sulphuretted hydrogen, and so indicates a rapid advance of putrefaction;" and again, "It is a fact deserving of attention that the substance of the spinal cord softens very rapidly after death, the lapse of half an hour, during which the nervous substance has been exposed to the air, often producing a manifest alteration." Indeed, there are reasons for believing that the amount of disorganization met with in the cord after death does not necessarily represent the exact amount which existed during life, and that a cord which is found to be broken up after death almost utterly, may have retained during life sufficient integrity to allow of the transmission of certain sensitive and motor impressions. On this view the return of slight sensation in the urethra and rectum shortly before death, and the preservation of the power of moving and feeling in the arms, which were noticed in the case which serves as my text, are not altogether unintelligible.

Induration, the other result of myelitis, is looked upon by some as a stage always preceding softening, but it would rather seem to mark, as Ollivier supposed, a less acute form of inflammation. In it the fibrinous products of the inflammation seem to have been more organizable. The cord thus indurated varies greatly in appearance; it may be almost as pale, bloodless, crisp, and hard as cartilage; it may be more or less red and vascular, and proportionably softer; and in either case, when examined under the microscope, its proper tissues are found to be broken up and destroyed almost as effectually as they are when the cord is softened. A cord which is indurated has usually a shrunken appearance, but it may be swollen considerably. There is no doubt an induration of the cord, as well as a softening, which cannot be referred to myelitis, and which must not be confounded with that which is the result of inflammation; but I must not stay to point out the differences, nor yet to do more than say that in myelitis there will in all probability be found, in addition to the signs which have been indicated, engorgement of the lungs, kidneys, and other viscera, possibly more marked vascular changes, with bed-sores, œdema, dry and scurfy skin, wasted muscles, and other signs of defective nutrition in the paralyzed parts.

3. CAUSES.—Nothing very much to the point can be said under this head, and the only remark I feel called upon to make is this, that as in spinal meningitis a rheumatic habit has been found to figure more or less conspicuously among the causes of the malady, so here a like position would seem to be due to a strumous habit. I would also confess to a growing impression that myelitis may not unfrequently be connected more with excess of sexual indulgence than with any other single cause, but I cannot say that this impression has yet taken the form of a definite conviction.

4. DIAGNOSIS.—In dealing with the symptoms of myelitis it has been shown that these are very different from those of spinal meningitis—so different as to make it difficult to confound them, if only moderate care be taken in realizing them. In spinal meningitis the most prominent symptom is pain in the back and extremities, produced or aggravated by movement; in myelitis pain of any kind has scarcely a title to be reckoned among the symptoms, pain produced by movement certainly not. In spinal meningitis the sensibility is somewhat exalted, in myelitis it is abolished. In spinal meningitis there is muscular weakness, and the muscular movements are fettered by pain, but there is no true paralysis; in myelitis paralysis is the symptom of symptoms. In spinal meningitis there is a state simulating trismus and tetanus, a state of muscular rigidity half voluntary as to its character, of which the object is to prevent certain movements which give rise to pain; in myelitis the muscles are limber, and there is usually an utter absence of any symptom akin to tremor, convulsion, or spasm.

Nor need the symptoms of common paraplegia (resulting from chronic myelitis) be confounded with those of locomotor ataxy. In common paraplegia there is paralysis more or less marked of the lower extremities, and the nutrition and irritability of the paralyzed muscles are, as a rule, unmistakably impaired; not so in locomotor ataxy. In common paraplegia the paralysis extends to the bladder and sphincter ani, and the sexual power is greatly weakened, if not altogether abolished; not so, or not to anything like the same degree, in locomotor ataxy. In common paraplegia the characteristic neuralgic pains of locomotor ataxy are wanting, and numbness is nothing like so prominent a symptom as in the ataxic disorder. In common paraplegia, where walking is possible, the gait—instead of being precipitate and staggering, the legs starting hither and thither in a very disorderly manner, and the heels coming down with a stamp at each step, as in locomotor ataxy—is hampered and slow, each leg being brought forward with evident difficulty, even with the help of an upward hitch of the body on the same side, and the part of the foot first coming in contact with the ground being, as a rule, not the heel, as in ataxy, but the toes. In common paraplegia impairment of sight or hearing, or strabismus, or ptosis, or injection of the conjunctivæ, or contraction of the pupils, frequent if not constant symtoms in locomotor ataxy, form no part of the history. In fact, in these respects, and in others of minor importance which might be mentioned, the histories of common paraplegia and locomotor ataxy are so different that it is not easy to see how, with only a moderate amount of care, the two disorders can be confounded.

Now and then, it is true, instances occur in which it is not so easy to distinguish this gait of common paraplegia from that of locomotor ataxy—cases in which the weakened muscles contract somewhat spasmodically when put in action, and in which there is often reason to believe that the membranes as well as the substance of the cord are affected, but, as a rule, the gait in common paraplegia and in locomotor ataxy is sufficiently characteristic to make it difficult to confound these two affections.

In cases where the myelitis is confined to the posterior columns of the cord, the symptoms will be those of locomotor ataxy rather than those which have been ascribed to myelitis; for, so far as the production of symptoms is concerned, it is of no moment whether the disease disorganizing the posterior columns be inflammatory or non-inflammatory, acute or chronic; and in other cases of local myelitis symptoms are sure to be present which cannot fail to lead to a correct diagnosis, if what was said in the preliminary remarks upon the physiology of different parts of the spinal cord be borne in mind in interpreting them. Indeed, with what is now known of the physiology of the spinal cord, there need not be much difficulty in determining the whereabouts of local mischief in the cord.

That myelitis cannot well be confounded with other spinal disorders—spinal congestion, tetanus, spinal irritation, and the rest—will be seen readily enough when a clear idea of these disorders has been realized, and only then; and this being the case, it is best to waive these questions in diagnosis until the fitting opportunities for dealing with them present themselves.

5. PROGNOSIS.—Acute myelitis affecting any considerable extent of the spinal cord is, without doubt, a very grave disorder. It may be fatal in fifteen or twenty hours, and it is seldom that life is prolonged beyond the end of the second week. Instances of recovery are on record, it is true, but these are very few in number, and of them there is, perhaps, no single one in which the correctness of the diagnosis may not be impugned. Even chronic myelitis is a very grave disease; for though life may be prolonged, especially where the disease is confined to the lower part of the cord, the mischief once done seems to be in a great measure irremediable. At the same time it is only right to say that of late years the results of treatment have been much more satisfactory, and that it is possible now to hope where there was little room for hoping formerly.

6. TREATMENT.—There appears to be little room for what is called active treatment even in acute myelitis. The inflammation is evi-

dently of a very low type, and, reasoning from what is known of its beneficial action in erysipelas and in some other low forms of inflammation, it seems to me that sesquichloride of iron would be likely to be of more real service than iodide of potassium. Indeed, I should be disposed, until I know of a better plan, to trust chiefly to full doses of this preparation of iron, to food and wine in no stinted quantities, and to the position recommended by Dr. Brown-Séquard for draining away blood from the spine—a position in which the patient is made to lie upon his abdomen or side, with his hands and feet in a somewhat dependent position.

With respect to the good or bad effects of belladonna, or ergot, or strychnia, it is not very easy to arrive at a satisfactory conclusion. I agree with Dr. Brown-Séquard, in thinking that belladonna and ergot may have the effect of counteracting a hyperæmic condition by causing contraction in the vessels, and that the vessels of the spinal cord may, perhaps, respond most readily to their action, but not as to the indication for employing these remedies. Pain and spasm are, to Dr. Brown-Séquard, signs of hyperæmia: to me, except the pain produced by movement, they are signs of irritation only—of a state which is connected, not with hyperæmia, but with anæmia, a state of contraction of the vessels which may pass into relaxation, but which need not necessarily do so; and, therefore, to me pain and spasm, instead of being indications for the employment of belladonna or ergot, are in very deed contra-indications. Nor can I agree in thinking that strychnia acts by increasing the amount of blood in the spinal cord and in its membranes, and that on this account it is contraindicated in hyperæmic conditions of these parts. Strychnia, without doubt, produces tetanic spasms and other unequivocal signs of spinal irritation, but it is begging the question altogether to suppose that the strychnia increases the amount of blood in the cord and its membrane, that this increase of blood augments the vital activity of the cord, and that the spasms and other signs of irritation attest this augmentation of vital activity. Indeed, so far from this being a necessary conclusion, all the evidence pointed out in the preliminary remarks, as it seems to me, points in the opposite direction, and connects the state of irritation of which the spasms are the signs, not with a hyperæmic condition, but with an anæmic; and most assuredly I know of nothing in the history of myelitis or spinal meningitis which is calculated to invalidate this conclusion. Moreover, the investigations of Dr. Harley upon the action of strychnia upon the blood go to show that this action is really equivalent to loss of blood in that it directly interferes with the proper arterialization of the blood. In a word, I cannot find any fundamental difference between the action of belladonna, ergot, and strychnia upon the bloodvessels, neither can I understand why, strychnia, properly used, might not be of as much service as belladonna or ergot, in lessening a hyperæmic condition of the cord. For my own part, however, I confess to a feeling which makes me hesitate to employ either belladonna, or ergot, or strychnia in myelitis, or in any analogous condition, until I know more of their action, or until I have more unequivocal empirical evidence of the good resulting from their use.

In chronic cases the one grand indication of treatment, as it seems to me, is to improve the nutrition of the cord, and the medicine best calculated to carry out this indication, cod-liver oil, sesquichloride of iron, phosphorus in one form or other, arsenic, and possibly bichloride of mercury, which latter preparation, when properly used, I believe to be tonic and antiseptic in a high degree, and in many respects much more analogous in its action to arsenic than to any of the photo-compounds of mercury in common use.

The local means for promoting the recovery of the paralyzed muscles are certainly of not less importance than the general means, possibly of much greater importance, and these local means are very various. The efficacy of frictions and shampooings appears to be indisputable. The efficacy of proper movements can only be doubted by those who are unacquainted with the results arrived at by the "movement cure," and by systematic movements of one kind or another, with or without the help of mechanical apparatus. The efficacy of faradization has been abundantly proved, and there is good reason to believe that this is not the only mode of using electricity which will be of great service; that in fact statical positive electricity, or the interrupted galvanic current, or the application of the galvanic current in such a way that the paralyzed nerve is acted upon chiefly by the positive pole—a mode of using electricity about which I have spoken elsewhere, and which I have used extensively during the last three or four years—will often be of great service in proper cases. Indeed I should think that the treatment was wanting in very essential particulars if these local means, one and all, were not associated with the general means of treatment, and employed systematically and perseveringly; and especially I should regard it as a great blunder if these local means were deferred so as to allow the paralyzed muscles to lose what when lost is not easily recovered—that is, their irritability and healthy organization.

There are also other local measures which are of great service in the treatment of paralysis, and one of these to which I am disposed to attach especial importance is to protect the paralyzed parts from cold. In many cases, as is well known, these paralyzed parts are cool, and in not a few instances, where the paralysis is incomplete or associated with early rigidity, this paralysis and rigidity is greatest when these parts are coldest. For example, it is no uncommon thing for a partially hemiplegic patient whose paralyzed fingers are contracted, stiff, and altogether useless when acted upon by cold, to be able to open his hand and use his fingers with comparative freedom when the hand is warm in bed, or placed in a warm bath, or held a while before the fire. At any rate, I have long been satisfied that the well wrapping up of the paralyzed parts in woollen or silken or India-rubber coverings is an important help in treatment.

It would also seem that good of the same kind, much good, may be got from an exhausting apparatus made on the principle of Junot's boot. The effect of such an apparatus, properly used, is to make the paralyzed parts warmer at the time, and to enable them to preserve this warmth for a considerable time—to produce a change in the circulation, which must have a good effect upon the nutrition and irritability of the paralyzed muscles.

It is also more than probable that electricity may be of service in improving the condition of the circulation in the paralyzed parts, for an increased feeling of warmth in the paralyzed parts is the result of faradizing these parts, or of electrifying them with statical electricity; indeed I have been more than once disposed to think that the beneficial effects of electricity in the resuscitation of paralyzed parts are as much brought about indirectly by changes produced in the circulation as by changes wrought directly in the nerves and muscles.

As regards the necessity for tenotomy and the use of orthopædic apparatus in certain cases, it is difficult to speak to any good purpose. I shall have to refer to these subjects when speaking of infantile paralysis, and here I will only say, that in many cases, in children especially, the cure will be greatly facilitated by tenotomy and orthopædic apparatus, and that it is not always easy to decide between the cases in which these measures are desirable and those in which they are not desirable.

III. Congestion.

Spinal congestion, or plethora spinalis, is not less definite in its history than myelitis or spinal meningitis; neither is it of less practical interest. In the sequel, indeed, it may appear, not only that spinal congestion is fully entitled to the place which has been assigned to it in the catalogue of diseases, but also that it really comprehends more than one spinal disorder which is now known under a different name.

1. Symptoms.—As an instance of well-marked spinal congestion, I take, in a condensed form, the notes of a case under my care not long ago.

Case.—Mary L., aged 28, but looking very much older; married, but never pregnant, was admitted into the Westminster Hospital on the 12th of June, 1866.

(*a*) With the exception of being able to turn her head on the pillow, and to move the fingers and toes a little, all power of voluntary movement appears to be wanting. The symptoms chiefly complained of are tingling in the tips of the fingers and toes, a dull, burning aching along the back and in the limbs, and a feeling of being "tired to death." If altered in anywise, the sensibility to touch, pain, tickling, and differences of temperature is somewhat more acute than natural. The spine is nowhere tender on pressure, but the dull, burning aching in this region is increased by the application of a sponge soaked in hot water. The soles of the feet may be tickled without giving rise to undue reflex movements. The bladder and bowels act properly. The mind is not at all affected. The state generally is evidently one of great exhaustion and prostration, without fever, the pulse being quick, unsteady, and very compressible, the respiration shallow and curiously interrupted by sighs.

(*b*) Three weeks ago menstruation, which had only just begun, was suddenly checked by an alarm of fire. This was shortly before bed-time. The next morning, after a very sleepless and miserable night, the state had become very much what it now is. Up to this time the patient had never been obliged to remain in bed a single day on account of illness. She had often been weak and ailing, and she had suffered a good deal at the menstrual periods from pain and weakness in the back and legs, and that is all. She also appears to have sprung from a tolerably healthy stock.

(*c*) Within the first fortnight after admission to the hospital, the tingling in the tips of the fingers and toes came to an end, and so did the aching in the back and limbs. A week later the arms, as well as the hands, could be moved a little. At the end of six weeks the legs remained almost as helpless as at first, but the arms and trunk had so far recovered power as to allow of a change from the lying to the sitting posture without any great difficulty. At the end of twelve weeks it was possible to get out of bed, and, with the help of a stick, to move to the table in the centre of the ward. On the 3d of December, five months after admission, the patient left the hospital convalescent. All this while the appetite was tolerably good, and the bladder and bowels acted properly. Now and then, in the progress towards recovery, especially about the menstrual periods, there were short relapses, in which the tingling in the tips of the fingers and toes, and the aching in the back and limbs came back, and the paralytic weakness of the muscles was almost as great as at first—in which the ground already gained seemed all but lost. Now and then, also, the nights were disturbed by a distressing state of shortness of breath, not amounting to asthma. Before the legs recovered power their muscles were somewhat wasted, but not considerably so; indeed, neither here nor elsewhere was the paralysis accompanied by any marked wasting of the muscles or by any appreciable impairment of electro-sensibility or electro-contractility. Moreover, any movement, whether active or passive, had always the effect of relieving rather than of increasing the aching in the back and limbs, when this symptom was present. The treatment pursued was chiefly rest, good living, hypophosphite of soda, nux vomica now and then in small doses, cod-liver oil, and faradization.

Assuming, as I well may, this to be a case of well-marked spinal congestion, I take as points of comparison between it and other cases of the kind, general and partial, these: suddenness of access; incomplete paralysis in a paraplegic form; no numbness; tingling in the tips of the fingers and toes; no exaggeration of reflex excitability in the paralyzed limbs; no want of control over the bladder and bowel; no spinal tenderness; aching in the back increased by warmth; pains in the back and limbs not increased by movement; no marked impairment of the electro-contractility and electro-sensibility, and no material wasting, of the paralyzed muscles; no feverishness; breathlessness; no bed-sores; proneness to relapses.

Suddenness of onset.—To be well, or comparatively well, on going to bed, and to be paralyzed in the morning, as in the case which I have given, is no uncommon thing in spinal congestion. It is indeed the rule rather than the exception for the illness to be spoken of as a "stroke" by the sufferer.

Incomplete paralysis in a paraplegic form.—Paralysis, often all but complete, but never quite so, and taking the paraplegic form, must be looked upon as a common symptom in spinal congestion. The paralysis is decidedly paraplegic in the end, and it may be so from the beginning, but not unfrequently one leg or one arm is affected before the other, and occasionally the leg and arm of the same side may for a short time be affected, as in hemiplegia, before the disease extends to the leg and arm of the other side. Not unfrequently there remains a difference in the degree of paralysis on the two sides, one leg or arm being more affected than its fellow. In cases where the congestion of the cord is general the arms as well as the legs are affected, the former perhaps as much as the latter; but in the common run of cases, where the congestion is confined chiefly to the lumbar region of the spine, the legs are exclusively or chiefly affected.

No anæsthesia.—Numbness is a symptom of myelitis, but not of spinal congestion. In the latter disorder, indeed, instead of numbness there is occasionally a state of things which may be spoken of as hyperæsthesia: thus, in a case very like the one I have given, which came under my notice in private practice about three years ago, the weight of a single bed-sheet was distressingly heavy to the patient, and long-continued aching of the paralyzed arms and legs was produced by handling them ever so lightly.

Tingling in the tips of the fingers or toes of the paralyzed limbs.—This symptom is almost always present at one time or other, coming and going and staying a longer or shorter time, often, as it would seem, very capriciously. One is glad to get rid of it, for while it remains it is difficult altogether to put aside the fear lest the state of the cord should pass out of spinal congestion simple into the graver disease of myelitis.

No exaggeration of reflex excitability in the paralyzed limbs.—Increased disposition to reflex movement is usually regarded as one of the symptoms in spinal congestion. It is supposed that the greater afflux of blood to the spinal cord must bring with it greater reflex excitability. I believe, however, that this supposition is not at all borne out by the facts. I believe, indeed, that the moderate reflex excitability in the case under consideration is not at all exceptional, and that it is the rule in all cases of spinal congestion for this manifestation of muscular contractility to be, if altered at all, diminished rather than increased.

No paralysis of the bladder or sphincter ani.—In myelitis, paralysis of the bladder or sphincter ani, more or less complete, is a prominent symptom: in spinal congestion, on the contrary, these symptoms are absent, except in those mixed cases where there is reason to believe that some degree of myelitis is also present. In the case which I have given there was not the least want of control over the bladder or bowel from the beginning to the end.

No tenderness on pressure along the spine.—Absence of spinal tenderness I believe to be the invariable rule, not only in spinal congestion but also in myelitis and spinal meningitis. I believe, indeed, that spinal tenderness is a sign of the presence of that functional disorder of the cord which is usually called spinal irritation, and that it does not accompany the graver diseases of the cord which have been named when they are uncomplicated with spinal irritation. Upon this subject I shall have more to say presently.

Dull aching along the spine increased by warmth.—I have noticed this symptom in three cases of well-marked general spinal congestion which have come under my own observation, and in many cases of partial congestion; and I am disposed to think that this will prove to be one of the points of difference between spinal congestion and spinal irritation. I have also noticed the same symptom in myelitis and spinal meningitis, and therefore I cannot regard it as having any special connection with spinal congestion. In fact, so far as my experience goes, I can say that this symptom is likely to be met with in congestive or inflammatory diseases of the cord, but not in spinal irritation simply; and that in this latter case, the local application of warmth to the spine is more likely to relieve pain than to cause it.

Pains in the back and limbs not increased by movement.—This symtom has some claim to be regarded as constant. The aching would seem to go and come with the congestion; and the fact, for fact it seems to be, that it is not increased by movement, may help to distinguish spinal congestion from spinal meningitis, for in the latter affection movement of the limbs, whether passive or active, is attended with pain in the parts moved and in the back.

No marked impairment of electro-contractility and electro-sensibility in, and no wasting of, the paralyzed muscles.—In myelitis the paralyzed muscles are prone to waste and to lose their electro-contractility and electro-sensibility, and herein, therefore, would seem to be a marked difference between this disorder and spinal congestion; for, so far as I know, the contrary state of things invariably holds good in spinal congestion. In speaking thus, however, it must not be forgotten that all muscles which remain paralyzed eventually lose their irritability and struction; and this equally, whether the paralyzing cause be myelitis, spinal congestion, or other.

No feverishness.—This is no special feature; indeed, fever would seem to have little to do with any affection of the cord, not even excepting meningitis in its most active form.

No bed-sores.—A marked disposition to bed-sores would seem to be the rule in myelitis, but not so in spinal congestion or spinal meningitis. Upon this point, more than upon many others, there is tolerable unanimity of opinion.

Shortness of breath.—Where the spinal congestion is at all general, this state of things may be readily accounted for by the paralytic weakness of muscles concerned in respiration. In the case which serves as my text, the occasional shortness of breath is noticed as not amounting to asthma; and this is a point of some interest, for it may be supposed that the difficulty of breathing would have taken this form—would have had something of a decidedly spasmodic character

—if the congested condition of the cord involved, as it is supposed to do, an exaggeration of reflex excitability.

Proneness to relapse.—Whether this may prove to be a constant feature in spinal congestion remains to be seen. That it is not an uncommon one is to me an indisputable fact.

Spinal congestion varies greatly in its degree, and in the extent of cord implicated. Limited to the lumbar region, and carried to a degree which produces, not paralysis, but weakness more or less approaching to paralysis in the legs, it is common enough; indeed, many women seem to suffer from it before every menstrual period; and between this partial and incomplete form and the general and complete form, of which the case which has been given is an instance, there are all possible grades of transition. It would seem to be most common in women, but it is not peculiar to the female sex or to any age. The onset of the disorder is generally sudden, in relapses as well as in original attacks: and the cases do not at all divide themselves into acute and chronic as do the cases of many other disorders.

2. POST MORTEM APPEARANCES.—These appearances are very vague and unsatisfactory, at most being simply some engorgement of the veins of the spinal cord and membranes, with some excess of the spinal fluid, both of which phenomena, as will be easily understood, are not very unlikely to escape detection unless the post-mortem examination be conducted with unusual care. With the exception of this engorgement and serous effusion, the only morbid sign which has been noticed (and this by no means constantly) is slight infiltration with blood of the cellular tissue exterior to the dura mater. In all uncomplicated cases, the structure of the cord and of its membranes is in nowise altered.

3. CAUSES.—As in the case which I have given, the suppression of the catamenia would seem to figure most conspicuously among the causes of spinal congestion, and next to this the cessation of hemorrhage from piles. Beyond this it is difficult to single out any one cause which has a just claim to be considered as at all special: and, for the rest, nothing further need be said except this—that spinal congestion is not unfrequently a consequence of pulmonary or abdominal congestion or inflammation—a consequence, perhaps, which has often more to do in compromising the safety of the patient than the primary disorder itself.

4. DIAGNOSIS.—Paraplegic paralysis is a symptom common to spinal congestion and myelitis, with this difference, that it is less complete in the former affection than in the latter. The paralysis is associated with anæsthesia in myelitis; not so in spinal congestion. The control of the bladder and bowels is lost in myelitis; not so in spinal congestion. The paralyzed muscles are prone to waste and lose their electro-contractility and electro-sensibility in myelitis; not so in spinal congestion. The imperfect paralysis and the absence of anæsthesia would seem, indeed, to connect spinal congestion more closely with spinal meningitis than with myelitis, and so also would the pain in the back

and aching in the limbs; but the pain and aching in spinal congestion cannot well be confounded with the pain which is met with in spinal meningitis, for the pain in this latter affection is produced by movement and accompanied by rigidity, whereas the pain in the former affection is not produced and accompanied in this manner. Hysterical paralysis, so called, agrees with the paralysis depending upon spinal congestion in some respects but not in others. It agrees in that the paralyzed muscles are neither prone to waste nor to lose their electro-contractility; it disagrees in that numbness is a prominent symptom, more prominent even than the paralysis, and that the electro-sensibility of the paralyzed muscles is either annihilated or very much diminished.

5. PROGNOSIS.—Recovery is the rule, no doubt, in cases of spinal congestion, but there is no difficulty in finding cases in which the disease has been fatal, and quickly fatal too. In the partial form, affecting the lumbar portion of the cord only, spinal congestion may come and go quickly without any great damage being done; but in the cases in which the cord is more extensively and more profoundly affected, as in the case which has been cited, recovery may occupy a considerable time. Thus, of the cases recorded by Ollivier, No. 55 remained in hospital nearly five months, No. 56 two months, No. 57 three months, and No. 58, "assez longtemps." Recovery is slow, as it would seem, because time is required for the absorption of the excess of spinal fluid to which the state of spinal engorgement had given rise.

6. TREATMENT.—What has been said respecting myelitis must be supposed to apply here equally. Indeed, the only special remark which appears to be called for in this place is this—that in cases where, as very generally it happens, the spinal congestion can be referred to suppression of a menstrual or hæmorrhoidal discharge, the primary indication would appear to be the setting up of an equivalent discharge by applying leeches to the os uteri or to the anus.

IV. TETANUS.

Tetanus is unhappily no rare or unfamiliar malady. The name, from τείνω, I stretch, refers to that rigid and cramped condition of the muscles which is the most characteristic symptom, and which, in sober earnest, is suggestive of rigor mortis, not only *in posse* but actually *in esse;* for there are some cases in which, without any interval of relaxation, tetanic rigidity at once passes into cadaveric rigidity. Hydrophobia alone excepted, tetanus is at once the most appalling and the most perilous of all spasmodic diseases.

1. SYMPTOMS.—As an instance of well-marked tetanus, I take the notes of such a case which I happened to see from the beginning to the end about six years ago.

Case.—Patrick M——, a fair, slightly-built, delicate-looking man, unmarried, aged 27, the coachman of a gentleman then under my care. On the 21st of April, 1861, as I was leaving the house of his master, I found him in the hall, and he took the opportunity of saying that he was not well enough to bring round the carriage, and of asking me what he had better do. What he complained of chiefly were a stiff neck and sore throat, with a feeling of weakness and illness. The stiff neck and sore throat made their appearance for the first time this day; the feeling of illness and weakness have been present for the last three days. The mouth cannot be opened so as to allow a fair look at the tongue, and a meal, it appears, has just been left unfinished, not for want of appetite, but simply on account of the difficulty experienced in masticating and swallowing the morsels. There is no feverishness.

P. M—— ascribes his present indisposition to having been out with the carriage several hours in the wet and wind three nights ago, and he says further that he is liable to colds. Before speaking to me, he had taken some opening medicine which a chemist had prescribed and prepared for him, and he thinks that this dose may account for the fact of feeling so ill and weak at the present moment. Some simple treatment was recommended, and I took my leave, not at all divining what was so soon to follow.

April 22.—Receiving information that this poor fellow was not so well, I went round to see him at his lodgings. I found him strangely altered. His teeth were firmly and inseparably clenched, and he looked literally like an old man—so like, that his mother, who lived with him, said that she could have thought his father had come back to life if only his hair had been gray. His voice had also become so low and indistinct as to make it difficult to catch what he said. The medicine given by the chemist yesterday, it appears, has purged him violently several times in the night, and more than once while at stool he has been seized with acute pain in the pit of the stomach, which took away his breath, and made him think he was going to die. It was in the night, while at stool, that the jaws became closed. I wished him to go to the hospital, and he was willing to do so, but his mother would not consent. Eggs beaten up with brandy were ordered to be given repeatedly, and every three hours a draught containing five grains of quinine and half a drachm of Hoffmann's anodyne. I now noticed on one of the fingers, which was tied up in a piece of rag, a small wound, healing and apparently healthy, the result of a tear by a rusty nail about a fortnight ago.

On a second visit, later in the day, I found that repeated attempts had been made in the interval to give the food and medicine, but with very trifling success. There was no great difficulty in getting the food or medicine into the mouth, for almost all the teeth on the right side were gone, but the attempt to swallow brought on spasm in the throat, and on more than one occasion the spasm forced the greater part of what was taken back through the nostrils. And this difficulty was all the more distressing, because a feeling of hunger prompted the patient of his own accord to make frequent attempts to swallow. The chief complaint now was of a dragging pain at the pit of the stomach, piercing through to the back. In answer to a question whether he could sit up in bed, he said, "I think I am too stiff to do so," and then he tried to sit up, and succeeded after making two or three abortive attempts. While sitting up I found that he could scarcely move his head, and that the muscles of the neck and back were very stiff and hard. I had only just noticed these phenomena when the noise caused by the upsetting of a chair brought on a fit of spasm, in which the patient was suddenly thrown backwards upon the bed with considerable force, and left resting upon his head and heels, in a state of complete opisthotonos—a state so complete as to make it possible for me to pass my hand under the loins without touching either the body or the bed. This severe spasm lasted not less than a couple of minutes, and the only muscles which did not seem to be implicated in it were the abdominal, those of the arms and hands, and those of the eyeball. In this spasm the complexion became dusky and livid, and the features altered in a frightful manner, the angles of the mouth being drawn upwards and outwards so as to give the expression known as the *risus sardonicus*, the set teeth being slightly uncovered, the nostrils spread, the eyes staring and prominent, the brow knit, the hair bristling—the complexion and features became changed, that is to say, as they are changed in sudden suffocation. All this while, too, the skin generally was dusky and hot and drenched in perspiration. For some time after this spasm had passed off the patient remained moaning, and unable to speak audibly, and then he said, "That pain will kill me if it comes back." I noticed, also, that there remained after this spasm a state of tetaniform rigidity and contraction, by which no inconsiderable degree of opisthotonos was still kept up. The eggs and brandy and the medicine were ordered to be given by enema.

April 23.—Two attempts were made to administer the enemata ordered over night without success, the irritation of the pipe in each instance bringing on a fit of spasm; indeed, all that it has been possible to give since my last visit have been a few sips of wine and water. There has been no sleep whatever during the night. During the last eighteen hours several fits of spasm like the one described have occurred, and the permanent rigidity and contraction remaining between the fits have increased. The abdominal muscles, which were not at all implicated yesterday, are now as hard and stiff as those of the neck, back, and legs. The pulse is quick (about 140), weak, and somewhat irregular; the breathing is shallow, hurried, and frequently checked by gasps and catches, even when it is not interrupted by the fits of spasm.

No material change has taken place since the morning. On one occasion in the course of the day an egg beaten up with some brandy has been swallowed, but all other attempts to administer food or medicine, whether by the mouth or by the rectum, have been rendered abortive by the fits of spasm to which they gave rise.

April 24.—Again the night has passed without sleep, and to-day the constant tetaniform contraction has become almost universal. In fact, the only muscles which are not obviously affected are those of the hands, and tongue, and eyeball. The fits of spasm, also, are now more frequent and severe, being not more than fifteen or twenty minutes apart, and lasting until death from suffocation seems even more than imminent; they are brought on by the most trivial causes

—an attempt to swallow, a draught of air, the simple straightening of the bedclothes—or they come on without any apparent cause. There is no improvement in the breathing and pulse, but if anything a change for the worse. During the fits the skin is hot, dusky, and drenched in perspiration: in the intervals it has an ominous coolness and clamminess. The mouth is full of viscid frothy saliva, and there is much thirst. While I was present a small quantity of dark urine was passed slowly and with some difficulty, and this appears to be the only time the bladder has acted for at least twenty-four hours. The pupils are large, especially in the paroxysms.

Shortly before I went again at the end of the day, there had been a momentary snatch of sleep, which had been abruptly brought to an end by an attack of opisthotonos, in which the tongue or cheek had been bitten, and now the frothy viscid saliva which filled the mouth to overflowing was deeply crimsoned with blood—a ghastly addition to a countenance already overcharged with horrors. During the last six hours the paroxysms have been less frequent and severe, but the vital powers are evidently fast ebbing away. "I cannot get my breath," was the answer slowly and almost inarticulately given to the question, "Have you much pain?"

Death happened about midnight, an hour after I had taken my leave, after a paroxysm of opisthotonos of no special violence, brought on, as it would seem, by an attempt to wipe away the bloody saliva from the lips. When I left the mind was perfectly clear and collected, and at no time, either before or after, was it otherwise.

For the rest it only remains to add (for the objections made to a post-mortem examination were insuperable) that the countenance appears to have retained after death the aged expression it had before death, and that the corpse when "laid out" was found to have stiffened without losing altogether the opisthotonic attitude. The mother of the patient is my only authority upon these points, for unfortunately it did not occur to me to make inquiries respecting them before the funeral had taken place.

In order to realize the points of resemblance and difference between this case and other cases of the kind, the course I propose to pursue is to take one after the other, as the points demanding attention, these—permanent muscular contraction, beginning by causing trismus, ending by causing opisthotonos, and implicating when at its height almost all the voluntary muscles except those of the hands, the eyeball, and the tongue; pain at the pit of the stomach piercing through to the back; difficulty of swallowing from the occurrence of spasm; fits of painful spasm in the permanently contracted muscles; risus sardonicus, and an aged expression of countenance, apnoea in the fits of spasm, and more or less dyspnoea at other times; profuse perspiration in the fits of spasm, with heat of skin; increased reflex excitability; absence of fever; absence of sleep; absence of numbness or tingling; absence of "head symptoms;" no marked want of control over the bladder and bowels; comparative voicelessness; the mouth clogged with viscid frothy saliva; a bitten tongue or cheek; dilatation of pupils; absence of priapism; presence of a wound; death by apnoea; early if not immediate rigor mortis.

Permanent muscular rigidity, causing, first, trismus, then opisthotonos, and implicating, when at its height, almost all the voluntary muscles except those of the hands, the eyeball, and the tongue.—Muscular rigidity, continuing without any marked relaxation from the time of its first appearance, is the most characteristic symptom of tetanus. It would seem to be the rule for this state of stiffness to begin in the muscles of the jaws, causing trismus, and to extend from thence as a centre, first to the muscles of the face and neck, then to those of the back, causing opisthotonos, then to those of the lower extremities, and, lastly, to those of the upper extremities, the progress in both extremities being from above downwards; but there are exceptions to this rule, for a few cases are on record in which the muscles of the neck have been affected before those of the jaws, and others, also only few in number, where the muscles near a wound, as of a stump after amputation, have been the first to become rigid. Even in the most extreme cases, the hands and the tongue are found to remain limber, and it is but very rarely, except perhaps in children with "head symptoms" in addition to the ordinary phenomena of tetanus, that a squint or a fixed stare shows that the deep muscles of the orbit are affected. Fits of spasm, of which more will have to be said presently, may seize upon the tongue, as they do very frequently upon the muscles of the throat in attempts to swallow, but there is no proof that either the tongue or the muscles of the throat are ever in a state of permanent contraction. Neither is there any certain proof that the heart or other involuntary muscles are in any degree permanently contracted. The affected muscles are very hard, curiously so, feeling very much as they do in rigor mortis, and they are not unfrequently somewhat tender when pressed or squeezed. In the great majority of cases, without question, the first effect of tetanic rigidity is to close the jaws and cause trismus, and the next to bend the body backwards and produce opisthotonos. Opisthotonos, indeed, is almost as characteristic and constant a result as trismus. Now and then, it is true, instead of the body being bent backwards it may be bent forwards (emprosthotonos), or sideways (pleurosthotonos), but these cases are quite exceptional, and *opisthotonos* may in reality be looked upon as the position which the body always takes or tends to take in tetanus.

Pain at the pit of the stomach piercing through to the back.—This is reckoned by the late Dr. Chambers as the pathognomonic symptom of tetanus, and in fact it is scarcely ever absent, not even at the very beginning. This pain is especially severe in the fits of spasm, and then it is often agonizing, but it is present also, if not in a severe, at least in a mitigated form, in the intervals between these fits, scarcely ever ceasing altogether, even for a moment, when once it has made its appearance. It depends, there is little reason to doubt, upon the diaphragm being implicated in the tetanic condition. Once it was looked upon as a certain death-warrant, but this opinion, as Mr. Curling has shown, is untenable.

Difficulty of swallowing from the occurrence of spasm.—This spasm, which is provoked by the attempt to swallow, may be in the pharynx or gullet, or in the cardiac aperture of the diaphragm, one or all, making swallowing impossible, and often leading to the violent ejection of fluids through the nose or from the mouth. The distress consequent upon it may sometimes cause a horror of liquids not unlike that which exists in hydrophobia, and it always constitutes a grave difficulty, for it not only incapacitates the patient from feeding in the usual way, but it prevents him from being fed by means of the stomach-pump.

Fits of painful spasm in the permanently contracted muscles.—These fits become more frequent as well as more violent and painful as the disease progresses, recurring when at the worst every ten or fifteen minutes, and lasting from one to two and a half minutes. So violent has been the muscular contraction in some of these fits, that the teeth and thigh bones have been broken, and great muscles like the psoas and recti femorales torn across. These fits of spasm are almost invariably very painful, the pain being that of cramp, but now and then the pain has been absent: thus, Sir Gilbert Blane mentions, on the authority of a surgeon in the navy, a case of severe tetanus, fatal in four days, in which the fits of spasm only gave rise to a sort of pleasurable tingling; and Mr. Curling instances an analogous case. Most generally the pain in the fit of spasm is felt chiefly at the pit of the stomach, and very often the pain in this region may be so agonizing and stifling as to make the patient insensible to pain elsewhere. Sometimes the pain in the neighbourhood of a wound, as in the stump after amputation, is that which is most complained of.

Risus sardonicus and an aged expression of countenance.—The sneering expression, caused by the angles of the mouth being drawn backwards and upwards, and known as the risus sardonicus, in association with spread nostrils, staring and prominent eyes, knitting of the brows, and bristling of the hair, is so often present as to be properly reckoned as pathognomonic of tetanus. In the fits of spasm the lips are often drawn apart so as to expose the set teeth, but sometimes they are kept tightly pressed together by the spasmodic action of the orbicularis oris. The aged expression which was present in the case I have given, is exceptional, but it has been met with in other cases. Thus, Mr. Curling refers to a case of idiopathic tetanus, related by Dr. W. Farr, in which the patient, who was only twenty six years of age, looked at least sixty; and he says further that he himself has "observed the same circumstance in an equally remarkable degree."

Dyspnœa with fits of comparative apnœa.—When tetanus is fully developed, an apprehension of suffocation is often present even in the intervals between the fits of spasm, and in these fits the suffused eyes, the livid countenance, and the agonizing struggle for breath show plainly enough that this is in no sense a groundless fear. How this difficulty is brought about is not easy to say, and probably the way is not always the same. Sometimes spasmodic closure of the glottis would seem to be a prominent cause; sometimes the thorax is, as it were, held in a vice by the spasm of all its muscles generally; must commonly perhaps these two causes act together. From my own small experience I should be disposed to attach less importance to the last cause than to the first, and I question whether much relief would be obtained in any case by carrying out Marshall Hall's suggestion of opening the windpipe in cases of tetanus.

Increased reflex excitability.—In P. M——, as the disease advanced, the fits of spasm were brought on by the most trivial causes—a draught of air, a sudden noise, an attempt to swallow, an attempt to administer an injection, the arrangement of the bed-clothes, the lightest touch even—and hence it may be inferred that increased reflex excitability was an element in this case. Nor is this case at all exceptional in this respect. As the disease advances, in fact, the controlling influence of the nervous system is removed, and this is all, for what are counted as signs of increased reflex excitability are in reality no more than signs of nervous exhaustion, such as manifest themselves whenever the vital powers are sufficiently lowered by loss of blood, or in any other way.

Profuse perspiration with heat of skin, in the fits of spasm especially.—In the fits of spasm the skin becomes hot and literally drenched in perspiration, and in a lesser degree this state of things continues in the intervals between these fits, except towards the end, when the chill damps of death show themselves. Sometimes the perspiration has a peculiar pungent smell, sometimes it is accompanied by a miliary eruption. The degree of heat attained is often considerable—in some cases as high even as 105° and 110.75° Fahr.

Absence of fever. —The heat of skin which has just been mentioned may at first sight appear to countenance the notion that fever is a part of tetanus, but it is evident on further inquiry that this phenomenon is mostly connected, not with fever, but with dyspnœa, the skin receiving more blood, and in that way acquiring increased temperature in obedience to that law of compensation by which to a certain degree the skin is obliged to do more respiratory work when the lungs do less than they ought to do. The thirst, also, which is often so much complained of when the disease is at its height, is owing less to fever than to the inability to drink the fluids necessary to the wants of the system, for the patient is often hungry at the very time he is tortured with thirst—a plain proof that he has no fever in the true sense of the word. Nor does the pulse support the idea of fever. On the contrary, the pulse points to exhaustion rather than to fever, being scarcely ever otherwise than quick and weak; and if in the fits of spasm it puts on a semblance of power, it is plain, from the state of suffocation obtaining at the time, that this change is simply owing, as I have elsewhere explained, to the difficult passage of imperfectly aërated blood through the capillaries. In fact, in the great majority of cases of tetanus there is no fever, and in the exceptional cases where some fever is present, its history shows that it is a consequence rather than a cause of the spasm, seeing that it is absent at first, and present only when the system is becoming exhausted by starvation, sleeplessness, and spasm.

Absence of sleep.—In the acute cases sleep, as a rule, is banished altogether, and even in the subacute cases this blessing is only realized in unrefreshing broken snatches. Want of sleep, indeed, is one of the not least distressing features of this disease. "The muscles," says Mr. Curling, "are observed to be relaxed during sleep, a striking example of which occurred to Mr. Mayo in a boy who recovered from the disease. On visiting his patient before the symptoms were subdued, Mr. Mayo found him asleep, and remarked that he lay perfectly relaxed. The abdominal muscles were soft and yielding, and had not the least tension. The boy was awakened, and at the instant the full tension of the muscles returned. Not being further disturbed, he fell asleep in a few minutes, when the muscles again became relaxed, and again, on his being awakened, resumed the state of spasm. I have on several occasions witnessed the same phenomena." Except the biting of the tongue, on waking from a brief nap, be a reason for believing that the muscles of the jaws had been relaxed during sleep, so as to allow the tongue to get between the teeth, there was no proof that the muscles were relaxed during sleep in the case I have given; but in other cases I have had proof sufficient of this relaxation.

Absence of numbness and tingling.—Of this there can be no doubt—that numbness and tingling form no part of the history of tetanus.

Absence of "head symptoms."—The mind is clear from the beginning to the end of the disease almost invariably, and not-unfrequently it is a matter for wonder how well the patient bears up under his atrocious sufferings—a marked difference this between tetanus and hydrophobia. And in the few instances in which delirium or coma has made its appearance a short time before death, it is not improbable, as more than one writer has observed, that this derangement is often more the result of the remedies employed than of the disease.

No marked want of control over the bladder or bowel.—In tetanus there is, as a rule, none of the difficulty with the bladder which is almost invariably met with in acute spinal meningitis. The bladder may act seldom, but it is not incapable of acting. Constipation is a common but not a constant symptom, and when it is present it may be a question whether, like the "head-symptoms," it is not as much due to the medicines used as to the disease. Now and then, however, there may be great difficulty in voiding the contents of the bladder and bowels, and in some of these cases the resistance to the introduction of a catheter or enema-pipe has shown that a part of this difficulty is owing to spasm of the compressor urethræ or sphincter ani.

Comparative voicelessness.—This phenomenon is readily accounted for as a result of the spasmodic interference with the action of the chest and of the tight shutting of the jaws. Indeed, it could not well be otherwise in the fully developed disease.

The mouth clogged with viscid frothy saliva.—This is a common if not a constant symptom, though not so marked in degree as in hydrophobia, and there is no difficulty in accounting for it in either case, for the inability to drink and swallow will explain at one and the same time why the saliva is viscid and why it accumulates in the mouth.

A bitten tongue or cheek.—This accident is of rare occurrence, and its rarity may be taken as an incidental proof of sleeplessness as a symptom of tetanus, for it is to be supposed that the opening of the jaws, from the relaxation of their muscles during sleep, would allow the tongue or cheek to get between the teeth—to get into that position in which the spasm which attends the moment of waking would be sure to crush them.

Dilatation of pupil.—This condition was always present in the case which serves as my text, especially in the fits of spasm, and this has been the rule in three cases of tetanus in which I have examined the pupil. Mr. Curling, on the contrary, found the pupil contracted in the majority of his cases.

Absence of priapism.—Mr. Morgan states that priapism occurs occasionally; but this observation is not confirmed by other writers on the subject. I have never seen it, and I am very much disposed to think that the case or cases in which Mr. Morgan saw it were cases, not of tetanus, but of acute spinal meningitis, in which disorder priapism is an occasional symptom.

Presence of a wound.—The great majority of cases of acute tetanus appear to be in some way dependent upon a wound or injury of one kind or another in one place or another. I shall have occasion to refer to this relationship elsewhere: and at present I would only notice, in passing, the presence of a wound which to all appearance presented no indications of an inflammatory or otherwise unhealthy character.

Death by apnœa.—Apnœa is one way, and perhaps the common way, in which death is brought about in tetanus. Not unfrequently, however, the patient sinks from asthenia, having been to a great degree free from fits of suffocative spasm for some time before death. Spasm of the heart has also been mentioned as a method of dying in tetanus, and the heart has not unfrequently been found to be curiously hard and contracted after death; but an examination of the facts tends very much to discountenance this idea, and to show that death is either by apnœa or asthenia, singly or together.

The immediate occurrence of rigor mortis.—Sommer and others have noticed that rigor mortis may occur without any appreciable interval of muscular relaxation after death from convulsions, and Dr. Brown-Séquard has confirmed this observation and given a definiteness to it which it had not before. He has indeed done more than this, for he has not only confirmed the fact that rigor mortis may occur without any appreciable interval of muscular relaxation, but he has established the law that rigor mortis is long in coming on and long in passing off where death was not preceded by any long-continued violent action of the muscles, and that it is quick in coming on and quick in passing off in direct proportion to the amount of long-continued violent action which preceded death. In many animals killed by strychnine, for example, in which death was brought about, not by one violent spasm, but by many, he has found rigor mortis set up before the heart had ceased to beat. Nay, he even refers to the case of a man under his observation in which rigor mortis occurred before the heart had ceased to beat. I have never witnessed this phenomenon either in animals or in man; but I have more than once failed to find any line of separation between tetanic stiffness and cadaveric rigidity in animals killed by strychnine, or by the shocks of a Ruhmkorff coil; and I am therefore quite prepared to understand that in P. M——'s case, where there were many convulsions before death, rigor mortis may have occurred without any appreciable interval of muscular relaxation, and in this way fixed in the corpse the aged expression of the countenance, and the opisthotonic attitude.

Two distinct varieties of tetanus are usually recognized, and properly so—the *traumatic*, in which a hurt of some kind or other is believed to be the primary cause; and the *idiopathic*, in which the only obvious cause would seem to be exposure to cold and damp. In each variety the symptoms are much the same, any difference of moment being only one of degree. In the acute form, the spasms come on suddenly, occur frequently, and grow in violence with each recurrence; in the less acute forms the spasms are more slowly developed in the first instance. the paroxysms are comparatively far between, and they do not recur with increasimg rapidity and violence. The traumatic, as a rule, is more acute than the idiopathic variety. Trismus nascentium is considered by many as a distinct variety of tetanus, but this appears to be a distinction without a real difference. It is tetanus in newly-born infants—traumatic, because the wound of the navel seems to have a good deal to do with its production, and at the same time idiopathic, for it is certain that cold and damp, and foul air, and other general causes also figure conspicuously as sources. It is, indeed to this form of tetanus that a remark of Sir Thomas Watson applies especially, which is applicable to all forms, namely, this, that "although tetanus may be excited by a wound, independently from exposure to cold, or by cold, without any bodily injury, there is good reason for thinking that, in many instances, one of these causes alone would fail to produce it, while both together call it forth."

2. Post-mortem Appearances.—There are no morbid changes in the nervous system peculiar to tetanus. "Serous effusion with increased vascularity," says Mr. Curling, "is generally observed in the membranes investing the medulla spinalis, and also a turgid state of the bloodvessels about the origin of the nerves," and the same changes may also be met with in the cranium, but in a less degree and less frequently. It is also a fact of considerable moment in relation to this point, that Magendie, Ollivier, and Orfila failed to detect any perceptible lesion in the spinal cords of animals dying from the tetanus produced by strychnia. Out of seventy fatal cases collected by Mr. Curling there were only two in which changes in the nervous system unequivocally the result of inflammatory action were discovered after death, and these two were cases where there had been a blow or wound to the back, where the symptoms had plainly to do with the inflammation of the cord or its membranes rather than with tetanus, and where the signs of inflammation found after death may, to say the least, be referred to the injury quite as easily as to the tetanus. Mr. Curling also points out, as a fact not to be overlooked, that the turgid state of the vessels of the pia mater, together with the effusion of serum which is met

with in the spinal cord and brain after death from tetanus, is also met in those persons who have been poisoned by opium, hydrocyanic acid, and other powerful agents often employed in the treatment of tetanus, as well as after death from delirium tremens, hydrophobia, epilepsy, and other diseases; and, as bearing upon these exceptional cases, in which unequivocal signs of inflammation in the cord or brain have been met with after death from tetanus, he says, "Whether inflammation be the result of injury or arises spontaneously, it is worthy of notice that the spasms, though continued and severe, do not occur in such violent paroxysms as in traumatic tetanus." Neither can the preternaturally injected state of the minute vessels supplying the sympathetic ganglia, especially the cervical and semilunar, met with by Mr. Swan and others in some cases of tetanus, be looked upon as at all constant phenomena after death from tetanus.

Traces of inflammation in the wound, especially in the injured nerves, may be met with after death from tetanus, and more frequently than in the spinal cord or other great nervous centres; but these again, instead of being constant, are not even common appearances. In the great majority of cases, indeed, the wound, if there be one, is perfectly healthy to all appearance and healing. Neither are there any other post-mortem facts which can be looked upon as essential to tetanus, for those which remain to be mentioned, as ruptured muscles, broken or dislocated bones, engorged lungs, injection and contraction of the pharynx and palate, worms in the alimentary canal, and others, are plainly accidental and exceptional.

3. CAUSES.—The two great causes of tetanus are, as has been mentioned already, cold and damp, and bodily injury of some sort. Exposure to cold and damp tells most in this manner when acting upon a body previously relaxed by heat and perspiring, and this is all that can be said, except that this exposure is more likely to issue in tetanus in a foul atmosphere than in a fresh one. As regards the hurt which may give rise to tetanus, it is difficult to know what to say. In the Peninsular war, as Sir James McGregor states, tetanus supervened on every description and in every stage of the wounds, from the slightest to the most formidable, in the healthy and sloughing, the incised and lacerated, the most simple and the most complicated; and this statement expresses the opinion of all surgeons, army-surgeons and others. Indeed, all that can be said is that punctured wounds seem to be more likely to issue in tetanus than incised, and wounds in the extremities more than wounds in the head, breast, and neck. And certainly an inflammatory condition of the wound cannot be regarded as essential. In a great number of cases, in the majority perhaps, the primary wound was completely healed and almost forgotten when the symptoms of tetanus made their appearance; and Dr. Rush, who had extensive opportunities for observation in the military hospitals of the United States, and who was unquestionably a most competent observer, remarks that there was invariably an absence of inflammation in the wounds causing the disease. John Hunter also says: "The wounds producing tetanus are either considerable or

slight. . . . When I have seen it from the first, it was after the inflammatory stage, and when good suppuration was come on; in some cases when it had nearly healed, and the patient was considered healthy. Some have had locked jaw after the healing was completed. In such I have supposed the inflammation to be the predisponent cause, rendering the nervous system irritable as soon as it was removed. When tetanus comes on in horses, as after docking, it is after the wound has suppurated and begun to heal." There is, indeed, abundant evidence to show that an inflammatory condition of the wound is not necessary to the production of tetanus, and some evidence even which is calculated to lead to a contrary conclusion, by showing that where an inflammatory condition of the wound has been present, this condition has passed off before the tetanic symptoms made their appearance—the inflammation, to repeat the words of John Hunter just used, "rendering the nervous system irritable *as soon as it was removed*," not rendering it irritable as long as it was present. The interval between the hurt and the development of the tetanic symptoms varies considerably. In eighty-one of the cases collected by Mr. Curling, the symptoms made their appearance between the fourth and fourteenth days, both inclusive, and in nineteen on the tenth day. Four cases are also given in which the symptoms came on more speedily, one (somewhat doubtful) almost instantaneously, another in one hour, a third in two hours, and the fourth in eleven hours, and, at the other extreme, one in which they were deferred as late as the tenth week. In traumatic tetanus the sooner the symptoms show themselves the more acute and dangerous is the malady. In idiopathic tetanus the symptoms, as a rule, commence sooner than in traumatic tetanus, often in a few hours; but the idiopathic notwithstanding, is generally of a more chronic kind than the traumatic, and far less dangerous.

Tetanus is not a malady peculiar to any country, or climate, or people, but it is more common in hot countries than in cold. It would appear, also, that negroes are more likely to be attacked than whites. Great atmospheric changes, especially from heat to cold and damp, as to a cold and dewy night after a sultry day, are evidently most favorable to the development of tetanus, and so in a less degree are foul air, despondency, terror, physical exhaustion. It must be confessed, however, that cases of idiopathic tetanus, as compared with those which are traumatic, or partly idiopathic and partly traumatic, are, to say the least, extremely rare in this country.

4. DIAGNOSIS.—The differences between tetanus and acute spinal meningitis are sufficiently marked to prevent any confusion as to diagnosis if only a moderate degree of attention be paid to the subject. In tetanus the jaw is firmly set from the first, and, in addition to the fits of spasm, there is permanent muscular rigidity between the fits; in spinal meningitis, if the jaw be set at all, it is rather at the close of the disease, and then only in an inconsiderable degree, and spasms or muscular rigidity are neither constant nor conspicuous phenomena. In spinal meningitis, indeed, it is plain that the muscular rigidity and

seeming spasms are in great measure voluntary or semi-voluntary acts to prevent the pain in the back and limbs which is produced by movement, and that the muscles are relaxed almost as long as the patient can keep perfectly still. In a word, the true involuntary fits of spasm and the permanent muscular rigidity which are constant and characteristic phenomena in tetanus, are not present in acute spinal meningitis.

Nor can hydrophobia be very well confounded with tetanus. In tetanus the features are drawn into the risus sardonicus, the eyes are natural, and the whole countenance is expressive of pain and suffering —nothing more; in hydrophobia there is an impress of excitement and distress and horror and unrest upon the features which has no counterpart in the tetanic countenance. In tetanus the body is for the most part rigidly fixed in one position by tonic spasm; in hydrophobia the spasmodic movements are clonic, and the body is in a state of perpetual unrest until the stage of final exhaustion. In hydrophobia, noisy attempts are continually made to spit and hawk away the viscid phlegm which fills the mouth and throat to overflowing—the noises being sometimes not altogether unlike the bark of a dog—and any effort to relieve the tormenting thirst, or even the bare thought of such an effort, brings on the fit of fear and convulsive agitation which has given rise to the name hydrophobia: in tetanus there are no symptoms which can be considered as strictly comparable to these. In tetanus, finally, the mind is clear to the last, whereas in hydrophobia there is almost from the first a peculiar and often very wild delirium.

The tetanic symptoms produced by strychnia and some other poisons may be more easily confounded with traumatic tetanus, but even here it is possible, with care, to make a correct diagnosis. It is possible, as Dr. Christison pointed out, for strychnia to be given in repeated doses so regulated as to produce a train of symptoms scarcely if at all distinguishable from traumatic tetanus; but not so if, as is usually the case, an amount sufficient to produce death be given in one dose. In this latter case, indeed, the differences of the symptoms are sufficiently marked. In the toxic tetanus the symptoms run a rapidly fatal course, death happening in a quarter of an hour, half an hour, and usually within the hour: in traumatic tetanus, with very few exceptions, life when briefest is prolonged for two or three days. In the toxic tetanus the arms are stretched stiffly out, the hands clenched, and the legs separated widely from each other and rigidly extended: in traumatic tetanus the hands are usually free from spasm, and the arms nearly so, and even the legs are scarcely ever affected to the degree which is seen in toxic tetanus. In the tetanus caused by strychnia, Mr. Poland says, "The patient can open his mouth to swallow; there is no locked jaw:" in traumatic tetanus, locked jaw is the first and most constant manifestation of the spasm.

The jaw may be locked for a long time, and various muscles in other parts may be affected with continuous spasm in cases in which hysteria is supposed to figure largely as a cause—cases in which there is the condition called spinal irritation, about which I have to treat in the next article: but these cases, as will appear in due time, even when most like, are in reality so unlike tetanus as scarcely to deserve even this passing mention.

5. PROGNOSIS.—In the cases "in which the access is slow, the spasms by no means violent, the paroxysms slight and recurring at long intervals, and where the patient can obtain sleep, whether traumatic or not, we may generally anticipate a favourable result;" and again, "the longer the interval before the appearance of the symptoms, the more chronic is the disease, and the greater the probability of recovery." So speaks Mr. Curling of the chronic cases of tetanus in contradistinction to the acute; and in illustration of the probability of recovery, he adds: "In thirteen cases, symptoms of tetanus occurred about three weeks after the wound, and four only were fatal; and of seven cases in which they did not make their appearance till after a month, only two ended fatally." In the cases, on the other hand, in which the spasms supervene rapidly upon the injury, and recur with increasing violence at decreasing intervals, and in which sleep is banished, a vast majority die—die, as Hippocrates noticed ages ago, within four days. Death may happen in a fit of suffocation in which sometimes there is obviously spasm of the glottis, but more frequently it would seem to be brought about by asthenia after a fit of spasm. The time occupied in recovery varies greatly—one, two, three, four, five, six, seven, eight weeks, or even longer. A certain degree of weakness and stiffness may also remain in the muscles long after recovery. In one case rigidity of the muscles of the jaw remained for six months; in another it returned whenever the patient caught cold up to nine months; and in a third, at the end of three years, it is stated that the "features retained the indelible impression of the disease." These cases are given by Mr. Curling.

6. TREATMENT.—After passing in review the principal remedies that have been tried in tetanus—opium, bloodletting, the cold bath and cold affusion, ice to the spine, the warm bath, bark, wine and spirits, mercury, purgatives, foxglove, tobacco, musk, prussic acid, carbonate of iron, oil of turpentine, strychnia, woorali, ether and chloroform inhalations, amputation, division of nerves, tourniquets—Sir Thomas Watson says: "In all cases, there being no special indication to the contrary, I should be more disposed to administer wine in large quantities, and nutriment, than any particular drug;" and this statement, I take it, expresses a very general feeling in this country. For my own part, I should certainly be more disposed to trust to alcohol than to any drug; but, in saying this, I do not say that I should place no confidence in drugs. I should certainly place no confidence in any sedative or narcotic given by the stomach in sedative or narcotic doses; but, on empirical as well as on theoretical grounds, I should say that opium can scarcely be dispensed with, and that chloroform or ether inhalations will be of infinite service in relieving pain and spasm, and that too without compromising the chances of recovery, if care be taken to pour in wine and to supply nourishment at the same time so as to prevent the patient from waking up almost immediately after the inhalation.

If the rationale of spasm be that which is hinted at in the preliminary remarks, the great indication of treatment must be, not to depress the circulation, but to rouse it into greater activity; and one reason why the treatment of tetanus has been so eminently unsatisfactory may be that this indication has not been fully realized and carried out. In tetanus much wine may be given without producing anything like intoxication, or without relaxing the spasms in any degree. The system in this disease is altogether insensible to the action of wine in ordinary doses. As to this there can be no doubt. Whether a different result would have been arrived at if alcohol had been given more boldly, ardent spirits in place of wine, ardent spirits undiluted rather than diluted, is yet an open question, but I am disposed to think that the spasms might have been conquered without compromising the safety of the patient if this had been done. There are now not a few cases on record which show that the bite of a rattlesnake or cobra or other deadly serpent may be prevented from killing by at once giving ardent spirits in sufficient quantity, and I am disposed to think that these facts have an important bearing upon the treatment of tetanus. There are, undoubtedly, great differences between the condition in tetanus and the condition in these poisoned bites, but there are also certain resemblances which must not be lost sight of. There is the same insensibility to the action of alcohol in ordinary doses; there is an exhaustion to be counteracted, which is more rapidly fatal in the poisoned bite than in tetanus, but which in acute tetanus is sufficiently rapid to create the gravest fears, and to justify the most heroic measures; there may be a poison at work in both cases as well as a wound, a poison introduced into the wound in one case, a poison generated in the wound in the other case. There are resemblances between the two cases, indeed, which, though not very close, may be close enough to justify the hope that a practice which has been found to answer in the bite of a poisonous serpent may also be found to answer in acute tetanus.

In speaking thus, it is not intended to imply that ardent spirits are the only way of fulfilling what has been said to be the primary indication of treatment in tetanus. Eau de luce has been found to be of great service in the bites of serpents, and it might be of service in tetanus. Ether, also, might be of use, or turpentine, or camphor, or ammonia. But to my mind these and other medicines of a like nature are more likely to disorder the stomach and system generally, and in other respects are less manageable and less certain in their action than ardent spirits, and for these reasons without any just claims to precedence in order of merit.

As regards local measures it is less difficult to arrive at a conclusion. In many cases, no doubt, there is an eccentric irritation, starting from the wound or some other point, and much good would be done if this could be removed. It is probable, also, that this end might be gained in more ways than one, and that one very direct way is by the subcutaneous injection of various substances—morphia, atropine, woorali, conia (which seems to be strictly analogous in its action to woorali), calabar bean, &c. The results of these injections in causing the relaxation of spasm in connection with the minor forms of spinal irritation are very encouraging. One thing, however, ought to be borne in mind, and that is, that these injections should be used so as not to produce a general depressing or paralyzing effect upon the nervous system. All that ought to be aimed at is to obviate local irritation merely; and, to my mind, to go beyond this point is both wrong in principle and dangerous in practice.

For the rest, it is, of course, desirable that the patient should be carefully guarded from cold, and from anything which would excite or disturb him, as too much light or noise, or too meddlesome nursing. In a word, quiet and warmth are not only desirable: they are indispensable.

V. IRRITATION.

The first important work on the disorder now generally known as *spinal irritation* was published by Mr. Teale, of Leeds, nearly forty years ago;[1] the next by the brothers Dr. and Mr. Griffin, of Limerick, about fifteen years later.[2] To Mr. Teale, indeed, belongs the credit of being the first to direct attention to this disorder, for, in reality, his claim either to priority or originality is scarcely, if at all, invalidated by the short communications which were made previously to medical periodical literature by Mr. Player, of Malmsbury,[3] by Dr. Brown, of Glasgow,[4] by Dr. Darwell, of Birmingham,[5] and still less so by anything written about the commencement of the century by Franks, Nicod, Ludwig, and others. It would also seem to be difficult to find any work of more recent date which deserves to be mentioned as at all equal in merit and importance to that of the brothers Griffin. The name "spinal irritation" was first proposed by Dr. Brown, of Glasgow.

1. SYMPTOMS.—The symptoms of spinal irritation at first sight appear to be as vague and various as those of hysteria. They are in reality so far hysterical as to be not readily distinguishable. When further examined, however, one symptom stands out prominently, with which the others are obviously connected in a peculiar manner; namely, spinal tenderness, and the upshot of the whole matter appears to be that spinal irritation is a definite malady which must not be confounded with hysteria or with any other disorder. The case I take as a text is as follows:—

Case.—An unmarried lady, aged twenty-three, who consulted me in the early part of 1863 for pains in the head and face, loss of appetite, nausea, flatulence, palpitation, breathlessness, "sinking feelings," weakness, and low spirits. The pain which was the chief suffering complained of, was sharp and neuralgic in its character, and varying in its seat, being sometimes in one part of the head or face, sometimes in another, and generally on the left side only. In the head it was often limited to a spot which might be covered with the tip of the finger, as in true clavus hystericus. Headache in one form or another was brought on or exaggerated by any effort, physical or mental: it was usually relieved by lying down and keeping perfectly still; it was scarcely ever absent except when face-ache had its turn; and sometimes it was so continuous and oppressive as to necessitate remaining in bed for days together. Nausea and sickness were its frequent accompaniment, and vomiting and great prostration were its common termination. In the cervical region of the spine there were considerable tenderness and a disagreeable feeling of weight, and pressure there brought on or increased the headache—the pain shooting from the occiput forwards—and caused a feeling of great nausea and oppression at the præcordia. The feet were always cold; "chills and flushes" were of frequent occurrence, and so were yawning, sighing, and stretching of the arms. Sleep was often made hideous by nightmare; fits of lowness of spirits and crying, attended by a sense of choking, as from a ball or knot in the throat, and followed by plentiful gushes of pale, limpid urine, were brought on by the most trivial causes; and the manner and appearance were altogether those of an eminently nervous or hysterical person. Menstruation was regular, neither excessive nor deficient, and it could not be said that the sufferings were either more or less at this time. The bowels also acted properly, and (but for the disposition to pass large quantities of pale urine, which has been already mentioned) so did the kidneys and bladder.

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[1] A Treatise on Neuralgic Diseases dependent upon Irritation of the Spinal Marrow and Ganglia of the Sympathetic Nerve. By T. P. Teale. 8vo. London: Highley, 1829.

[2] Observations on the Functional Affections of the Spinal Cord and Ganglionic System of Nerves, in which their Identity with Sympathetic. Nervous, and Irritative Diseases is illustrated. By William Griffin, M.D. and David Griffin. 8vo. London: Burgess and Hill. 1844.

[3] Quarterly Journal of Science, January, 1822.

[4] Glasgow Medical Journal. May, 1828.

[5] Midland Medical and Surgical Reporter, May, 1829.

These symptoms, it appears, had their starting-point about twelve years ago in the shock and grief caused by witnessing the death of a brother, her last remaining near relative, in an epileptic fit, and ever since this time they have continued very much as they now are, with but little intermission. Before this time the personal history of the patient was tolerably good, but not so her family history; for, in addition to the brother whose death in epilepsy has just been mentioned, it appears that her father died years before of phthisis, and that her mother is now in a lunatic asylum.

Under the use of a more liberal diet, with ammonia and calumba, and with occasional blisters to the nape of the neck, health was re-established in little more than a month, notwithstanding the fact that several days at the commencement were wasted in overcoming a dislike to take the wine and medicine necessary—in converting, in fact, the patient from a firm belief in teetotalism and homœopathy.

Towards the close of the same year, 1863, this young lady again returned to me, looking very worn and thin, with all her old symptoms in force, and with cough and difficulty of breathing in addition. The cough was very violent, barking, unattended with expectoration, and often carried on until it ended in retching and vomiting. The difficulty of breathing was chiefly at night: usually it did not amount to more than what might be met by a voluntary effort at inspiration;

now and then it seemed to deserve the name of asthma; almost invariably it was accompanied, not by a feeling of a ball or knot in the throat, but by a sharp pain in the left hypochondrium, or else by severe aching in the left shoulder and down the left arm. Percussion and auscultation failed to bring to light any signs of disease in the heart or lungs, but pressure along the spine revealed tenderness in the cervical and upper dorsal regions, in the latter especially, and at the same time brought on cough, deep inspirations, pain and throbbing at the epigastrium, and a feeling of great faintness and breathlessness.

On this occasion a very fair state of health was soon re-established by the plan of treatment which proved successful in the first instance.

At the beginning of 1865, this lady, then married, again required my services. For three weeks before my seeing her she had been in bed, with her thighs drawn up tightly against her abdomen, and with her heels buried in her nates. This contraction was unremitting during the waking state, and only partially remitting during sleep: it was unattended by pain; and it could be partially overcome, for a time, without causing much pain in the contracted muscles, by slow and steady extension. The headache and face-ache had gone months before, and so had the pain in the epigastrium and in the left shoulder and arm: the cough and difficulty of breathing and palpitation were of very unfrequent occurrence: the appetite and digestion and the action of the bowels were tolerably natural; and what was complained of now were colicky pains in the lower part of the abdomen, pains often very severe and sickening about the loins and hips, and in the region of the left ovary, with constant calls to pass water, and much pain in the urethra in attending to these calls. The spine was now tender, not as before, in the cervical and dorsal region, but low down in the lumbar region, and pressure on the tender part brought on colicky pains in the lower part of the abdomen, and a cutting pain in the urethra, with an almost irresistible impulse to pass water then and there. Pressure in the cervical and dorsal regions of the spine gave rise, not to the marked symptoms produced in this way in the two previous illnesses, but simply to a disagreeable thrill all over the body. There was no numbness or tingling in the legs or elsewhere, and no hyperæsthesia, except perhaps to a very trifling degree over the left ovary. Tickling the soles of the feet gave rise to painful spasmodic shocks in the legs, to a disagreeable thrill passing up the body as high as the throat, and to the involuntary escape of a small quantity of urine. The condition as to general health was tolerably good—much better than during the two previous illnesses; and, in fact, the only sign of disorder, in addition to those which have been indicated (and this can scarcely be reckoned as such), was the absence of menstruation since the birth of a child about three months ago.

Somewhat more than twelve months ago, after having been quite well for the year previously, this patient married and became pregnant. In the early months of pregnancy she had much headache, depression, weakness, and sickness; but after a while these symptoms passed off, and everything went on smoothly and satisfactorily until two months after confinement, when her baby died suddenly. And then began her present troubles. The fretting about her baby brought back the old headaches, the headaches produced great sleeplessness and irritability of the stomach, and then came on a state of uncontrollable fidgetiness which kept her incessantly moving about until her legs, one leg especially, failed altogether, and obliged her to take to her bed. The very next morning her legs had become contracted, and she herself is convinced that this change for the worse, as she regards it, was brought about by the pain and loss of blood produced by introducing a large speculum and by applying leeches to the os uteri on the previous evening.

The treatment on this occasion consisted chiefly in a liberal allowance of food and wine, in repeated blisterings to the lumbar region of the spine, and in the administration of bromide of potassium and ammonia; the result was the cessation of the contractions in about three weeks, and the complete re-establishment of health in about two months and a half.

In commenting upon this case with the view of separating the general phenomena of spinal irritation from the particular, I take the following as the points which most deserve to be attended to, namely, these:—spinal tenderness, neuralgia, spasmodic cough and difficulty of breathing, palpitation and vascular throbbings, nausea, vomiting, and eructations, and irritability of the bladder, all in connection with spinal tenderness; the connection of particular symptoms or groups of symptoms with tenderness in particular parts of the spine; prolonged muscular contraction; no paralysis of the limbs; no paralysis of the bladder or rectum; no numbness; variability and inconstancy of the symptoms; a nervous constitution.

Spinal tenderness.—In the great majority of cases this symptom would seem to be present in spinal irritation and absent in spinal meningitis, myelitis, or spinal congestion, acute or chronic. It would seem, indeed, to deserve to be regarded as the pathognomonic symptom of spinal irritation; for in the few cases of spinal meningitis, myelitis, or spinal congestion in which it is met with, there is reason to believe that its presence may be accounted for by the association of the phenomena of irritation with those of inflammation or congestion. At any rate, it is certainly the rule that spinal irritation without spinal inflammation or congestion is accompanied by spinal tenderness, and that spinal inflammation and congestion without spinal irritation is *not* accompanied by spinal tenderness. Spinal tenderness, however, can scarcely be spoken of as a prominent symptom in spinal irritation. It is often not complained of until it is specially inquired after; and now and then its existence is not even suspected by the patient until he or she is made to wince under pressure applied to the spine. In a few cases which from their symptoms would seem to come under no other head than that of spinal irritation, there is no spinal tenderness—only five such cases are met with among the 148 cases brought together by the brothers Dr. and Mr. Griffin, and these may without difficulty be in great measure explained away; but such cases are much too exceptional and doubtful to throw discredit on the rule in question, that spinal irritation and spinal tenderness go together. Spinal tenderness, however, does not appear to be equally marked in all forms of spinal irritation. It appears to be much less marked where the irritation shows itself in spasm and prolonged muscular contraction than in the cases where it shows itself in pain; and it is certainly absent in tetanus, which in one sense may be looked upon as the manifestation of spinal irritation in its most aggravated form.

Nervous pains, often in connection with tenderness in a particular part of the spine.—Nervous pains, neuralgias, in one place or another, often intermittent and more or less regularly periodical, and often shifting suddenly from one place to another, are a very common, perhaps the most common, symptom in spinal irritation. They are often brought on or exaggerated by lifting any weight, by twisting or straining the back in any way, or by any effort, mental or physical: and as often they are relieved, to some extent at least, by lying down. Very often, also, there is tenderness in the portion of the spine corresponding to the insertion of the affected nerves—in the upper cervical region, where the pains are in the scalp (clavus hystericus, megrim, and others), face, or neck; in the lower cervical region, where they are in the upper extremities, shoulders, and upper part of the thorax; in the dorsal region, where they are in the lower part of the thorax and upper part of the abdomen (pleurodynia, gastrodynia, infra-mammary stitch, and others); in the lumbar and cervical regions, where they are in the lower part of the abdomen, hips, loins, and lower extremities. In the majority of cases the pain would not seem to be in the part of the spine which is tender, or in any other part. In some cases there may be aching in some part of the spine, or else a sense of weight and heat; but I am very much inclined to believe that these last mentioned symptoms, and "back ache" generally, have often to be referred to spinal congestion rather than to spinal irritation in its uncomplicated form. When the spinal tenderness is very great, slight pressure will often cause pain to strike from the tender spot of the spine to the distant seat of pain, or will bring about or exaggerate this pain. This fact is illustrated in the case I have given, and better still in some of the cases related by the Griffin brothers. In one of these cases, for example, where the whole spinal column was found to be acutely tender, "pressure of the first or second vertebra occasioned pain, which shot forwards from the occiput to the brow; a little lower, pain was excited at the larynx; on pressing one of the lower cervical, it occurred at the point where it dips behind the sternum; on pressing the upper dorsal, at the middle of the sternum; from the third or fourth dorsal to the eighth or ninth, it was excited at the ensiform cartilage; yet lower, at the sides; and in the lumbar vertebræ, pain was excited in the iliac and pubic regions" (p. 19). And in another case, where there was some tenderness of the middle cervical vertebræ, and acute tenderness from the fourth dorsal to the eighth or ninth, "pressure on any of those last, especially the seventh or eighth, brought on violent pain, which darted forwards to the ensiform cartilage. When the last mentioned vertebra was pressed upon, the patient said that she thought her 'heart would break'" (p. 119). The pain is often curiously localized: sometimes it gives the idea of a nail being driven into the part, as in clavus hystericus; sometimes the feeling produced by it is as if a walnut or other hard substance were pressed under a tight belt; sometimes it is very severe, and neuralgic in its character rather than rheumatic: and not unfrequently, when it has existed some time, the painful part becomes tender on pressure. Most generally this morbid sensation is in the form of pain, but now and then it may take that of cold, tingling, itching, or some other feeling which is disagreeable rather than painful. The amount of constitutional disturbance attending the pain varies very much, but it is usually comparatively trifling, and, as it would seem, quite out of proportion to the degree of suffering.

Nausea, retching, vomiting, eructation, &c., often in connection with tenderness in a particular part of the spine.—These are common symptoms in spinal irritation: next to pain, indeed, they are perhaps the most common. They are also intimately connected with certain forms of pain, especially cephalalgia and gastrodynia, sometimes preceding, sometimes accompanying, but more generally following, the pain. As regards the particular part of the spine which is likely to be tender when the stomach is the seat of irritation, the Griffin brothers say that "nausea and vomiting appear to bear more relation to tenderness of the cervical spine, pain of stomach to tenderness of the dorsal; but that where there was soreness of both, nausea and vomiting was still more frequent, and pain of stomach scarcely ever absent." The epigastric disorder in these cases is generally accompanied with tenderness on pressure, not merely in the spine but also in the epigastrium and in the left hypochondrium—with those three patches of tenderness which M. Briquet speaks of as the "trépied hystérique"—as the tripod upon which the diagnosis of hysteria rests.

Spasmodic cough, difficulty of breathing, &c., often in connection with tenderness in a particular part of the spine.—These again are symptoms which are common enough in spinal irritation, and mostly so, as it would seem, when the tenderness in the spine is in the cervical and upper dorsal region.

Palpitation, &c., often in connection with tenderness in a particular part of the spine.—Palpitation is another symptom of spinal irritation which seems to be oftenest met with when there is tenderness in the upper half of the spine. It seems to be not unfrequently associated with a feeling of epigastric pulsation, and with nausea, vomiting, and other signs of gastric disorder. Vascular throbbings in other places, as in the temples, and "chills and flushes," and a disposition to syncope, and other signs of disturbed balance in the circulation, may, and often do, go hand in hand with the palpitation, and seem to have to do with the same condition of the spine.

Irritability of the bladder, often in connection with tenderness in a particular part of the spine.—This was a marked symptom in the case which I have related when the seat of spinal tenderness shifted to the lumbar region, and it seems to be a very common, if not a constant symptom, in cases in which the tenderness is in this region.

The connection of particular symptoms or groups of symptoms with tenderness in particular regions of the spine.—The data best calculated to illustrate this connection are those supplied by Dr. and Mr. Griffin. These consist of no less than 148 cases, of which 26 are in males, 49 in married women, and 73 in girls. In these 148 cases, the spinal tenderness was in the cervical region in 28, in the cervical and upper dorsal region in 46, in the dorsal region in 23, in the dorsal and lumbar region in 15, in the lumbar region in 13, and in the spine generally in 23. In the following table the prominent symptoms connected with each one of these forms of spinal tenderness is set forth in a way which requires no comment except this—that this grouping of symptoms with tenderness in particular parts of the spine must only be looked upon as approximating to the truth, and that now and then any symptom may appear out of the order in which it is set down.

Region of Spinal Tenderness.	*Prominent Symptoms.*
A. *Cervical region.* Cases 28 in number.	Headache, nausea, vomiting, face-ache, fits of insensibility, cough, pains in the upper extremities, etc. ⁂ Nausea and vomiting in 5 cases, pains of stomach in 2 only.
B. *Cervical and Dorsal region.* Cases 46 in number.	In addition to the symptoms in group A, pain of stomach and sides, pyrosis, palpitation, oppression. ⁂ Pain of stomach in 34 cases, nausea and vomiting in 10.
C. *Dorsal region.* Cases 23 in number.	Pain in the stomach and sides, cough, oppression, fits of syncope, hiccup, eructations. ⁂ Pain in the stomach in almost all these cases, nausea or vomiting in only one.
D. *Dorsal and Lumbar region.* Cases 15 in number.	In addition to the symptoms in group C, pains in the abdomen, loins, hips, lower extremities, dysury, and ischury. ⁂ Nausea in only one case.
E. *Lumbar region.* Cases 13 in number.	Pains in the lower part of the abdomen, testes, or lower extremities, dysury, ischury, disposition to paralysis in lower extremities. ⁂ Retching and spasm of the stomach in one case only.
F. *All regions together.* Cases 23 in number.	A combination of the foregoing groups of symptoms, one group changing into another as the spinal tenderness becomes more marked in one region than in another.

Prolonged muscular contraction.—This is a very conspicuous symptom in the case which serves as my text, and it is no uncommon symptom in other cases of spinal irritation. The lower extremities appear to be the parts most commonly affected, one or both of them; but the upper extremities can claim no exception, nor even the muscles of the jaws and neck, trismus or torticollis being among the results in this latter case. "Occasionally," says Mr. Teale, "there is an inability to perform complete extension of the elbow, the arm appearing restrained by the tendon of the biceps, pain and tightness being produced in this part when extension is attempted beyond a certain point;" and to this fact I can testify. Moreover, I can testify as to the not unfrequent occurrence of long-continued closing of the fingers and thumb upon the palm. The rule appears to be, for the extremities to be affected before the trunk or head. This contraction, which is generally painless, may be prolonged for weeks or even months continuously even during sleep, or with occasional intermissions of uncertain duration; and the attacks, primary or secondary, are usually found to begin and end suddenly and unexpectedly. The relations between this form of contraction and that which occurs in other cases, especially in tetanus and in that somewhat vague disorder to which Dr. Trousseau has given the name of tetany (tétanie), are not very easily determined. In tetanus, with very rare exceptions, the contraction is painful, especially in the paroxysmal bouts, and the order in which it attacks the body is different—first, the jaws; then the trunk; and the extremities only at a late period, if at all. In tetany, as in tetanus, the contraction is painful, but the order in which the body is attacked is different to that which is observed in tetanus, centripetal not centrifugal—first, the extremities, then the trunk or head; the contraction, in fact, being confined to the extremities, except in cases of unusual severity. In the way in which it affects the extremities first, and often exclusively, the contraction of tetany agrees with the contraction under consideration, but in other respects it differs. It differs, especially, in being ushered in and accompanied by symptoms which do not seem to form part and parcel of simple spinal irritation; namely, tingling and some degree of anæsthesia, and also (so it is said) in the form of the contracted hand being peculiar—like that which the hand of the accoucheur takes in order to be introduced into the vagina—and in the possibility of bringing on the contraction by firm pressure upon the principal nerves or arteries of the affected muscles. It may be questioned, however, whether there are absolutely fixed lines of division between these different forms of prolonged contraction and whether the difference which exists may not be accounted for as the result of different degrees of irritation, affecting, it may be, different parts of the spinal cord. It may be questioned, also, whether a sufficient case is made out for describing tetany as a definite disorder, and whether it is not rather a form of spinal irritation complicated with some graver spinal disease—spinal meningitis, myelitis, spinal congestion—in varying proportions. The association of tingling and numbness with the prolonged contraction is, as it seems to me, a reason for an affirmative conclusion. At any rate, prolonged muscular contraction, be its significancy in tetanus or tetany what it my must be looked upon as a not unfrequent symptom in simple spinal irritation—as a symptom, too, which is usually of no very grave import. Of this there need be no doubt.

No paralysis of the limbs.—In the case I have given in illustration there was great weakness of the legs, and one leg seemed to "drag" immediately before the contractions came on. There was a disposition to paralysis in the legs, but not more than this; nor do I find paralysis of the limbs among the symptoms of spinal irritation strictly so called. There is, no doubt, a connection between paralysis and spinal irritation which cannot be overlooked; and under that form of paralysis which is known as "hysterical paralysis," and about which more will have to be said in due time, and under spinal irritation, there is a common basis. As it seems to me, however, it is pathologically as well as physiologically incorrect to speak of hysterical paralysis as a symptom of spinal irritation. Also, it seems to me, the right place of this paralysis is after spinal irritation, not along with it, when the capability of morbid action which is implied in the term irritation is worn out; and so in the other exceptional cases in which paralysis is connected with spinal irritation, it will, I believe, be found on careful examination that the paralysis is not a symptom of actual spinal irritation, but of a state of vascular change into which this irritation may issue and has issued—spinal congestion, it may be, or even myelitis.

No paralysis of the bladder or bowel.—The remarks which have just been made apply equally to paralysis of the bladder or bowel. Paralysis in either of these organs, or even a disposition to it, is rarely met with in any case which can be strictly brought under the head of spinal irritation; and in the few exceptional instances which do occur, it is plain enough, when the matter is fairly inquired into, that the boundary has been passed which separates the state of irritation from the state of exhaustion, and that, in fact, the case is no longer one of simple spinal irritation.

No numbness.—Numbness, again, is a symptom which is scarcely ever met with in cases to which the name of spinal irritation is strictly applicable, and, when it is met with, it is easily accounted for. In short, the relationship of numbness and paralysis to spinal irritation appears to be one and the same, the numbness and the paralysis being alike connected, not with the state of morbid action called irritation, but with the after-state of morbid inaction for which exhaustion seems to be one of the appropriate names.

Variability and inconstancy of symptoms.—One most characteristic feature of spinal irritation is the way in which one symptom or group of symptoms may change, and change suddenly, into another symptom or group of symptoms. It is now this disease which is simulated, now that, there being scarcely any disease which may not be simulated: at one time the head is affected, at another the chest, at another the abdomen or the extremities: and the only thing constant among these ever-shifting phenomena appears to be this—that the spinal tenderness changes from one part to another in a manner which is intelligible enough when the connection of the spinal nerves with the affected part is taken into consideration.

A nervous constitution.—The subjects of spinal irritation, with few if any exceptions, may be spoken of as hysterical, hypochondriacal, or nervous. They have, in fact, that nervous constitution which Whytt, following in the steps of Sydenham, showed to be the common basis of hysteria and hypochondriasis. First in order among the signs of this constitution comes that sign which Sydenham regarded as pathognomonic of hysteria and hypochondriasis—namely, a proneness to pass, under or after strong emotion or excitement, large quantities of pale limpid urine. Then come other signs scarcely less characteristic: proneness to tenderness, not only in some part of the spinal column, but also in the epigastrium and left hypochondrium—*le trépied hystérique* of Dr. Briquet already referred to; proneness to sudden and distressing flatulent distension of the stomach and bowels, with loud rumblings and explosions, and with a feeling of a ball rolling about, first in the left flank, and then mounting, or tending to mount, into the throat, where it gives rise to a sense of choking and to repeated acts of swallowing; proneness to bursts of crying and sobbing or of laughing; proneness to sighing, yawning, and stretching the arms; and proneness to fits of convulsive agitation and struggling. Then come a promiscuous series of signs: proneness to erratic pains of a neuralgic character, breathlessness, nervous cough, palpitation, throbbing in the temples, epigastrium, and elsewhere; "flushes and chills," syncope, hiccup, nausea, vomiting, aversion to food or unnatural craving for it, heartburn, oppression at the præcordia, languor, debility, fidgetiness, tremulousness, vertigo (especially on rising hastily), ringing in the ears, "animus, nec sponte, varius et mutabilis," fancifulness and inability to discriminate between fact and fiction, undue lowness of spirits or the contrary, and a host of other symptoms whose name is legion. Not only, indeed, is the name of these different symptoms legion, but there is ever going on a process of mutual metamorphosis in the symptoms themselves; and, in conclusion, it is this very hysterical or hypochondriacal variability and mutability of the symptoms which must be looked upon as the great characteristic of the nervous constitution.

2. Post-mortem Appearances.—The morbid structural changes strictly belonging to spinal irritation are *nil*. The disease is nervous or functional in its character, and on this account it leaves no obvious traces after death. Still, as Dr. Copland wisely says, "an affection which may with justice be viewed as functional to-day—as spinal irritation merely—may be inflammation on the morrow, and rapidly followed by the consequences of inflammation." Such a termination, however, is altogether exceptional: and when it does occur, the history during life will show very clearly that any traces of inflammation which are met with after death are to be ascribed, not to irritation, but to inflammation. How far irritation, which involves in its very essence, as I believe, capillary contraction and bloodlessness, not capillary paralysis and congestion, may involve changes which are

opposed to inflammation—deficiency of blood and organic changes brought on by the part being starved for want of blood—remains to be seen. I take it that such changes would have been found if they had been looked for with the same amount of care which has been expended in the search for inflammatory changes: but the investigations have yet to be made which will verify or disprove the conjecture.

3. CAUSES.—Neglect of gymnastic training, insufficiency of wine or other alcoholic drinks, over-indulgence in sexual matters, onanism, would seem to deserve a conspicuous place among the causes of spinal irritation. It is idle, however, to weigh the importance of particular causes, or even to attempt to individualize them, and it is enough to be content with the broad fact that everything which tends to induce a nervous habit—that is, everything which exhausts vital power—must be reckoned as a cause. I believe that the starting-point of the disorder will very often be found in some strain or blow to the back, and I also believe that a congenital predisposition may also be detected in very many cases.

4. DIAGNOSIS.—The fundamental question for consideration in this place is how to distinguish between functional and organic affections of the spinal cord, and this question fortunately is one which is less difficult to answer than it might seem to be at first sight. In fact, the characteristics of spinal irritation indicated by the Griffin brothers, are sufficient of themselves to supply the answer to any one who has tolerably clear ideas respecting the principal diseases with which spinal irritation may be confounded. These characteristics are: "1st. The pain or disorder of any particular organ being altogether out of proportion to the constitutional disturbance. 2d. The complaints, whatever they may be, being usually relieved by the recumbent posture, and always increased by lifting weights, bending, stooping, or twisting the spine. 3d. The existence of tenderness at that part of the spine which corresponds with the disordered organ, and the increase of pain in that organ by pressure on the corresponding region of the spine. 4th. The disposition to the sudden transference of the disordered action from one organ or part to another, or the occurrence of hysterical symptoms in affections apparently acute; and 5th. The occurrence of fits of yawning or sneezing, which, though not very common symptoms, yet, as rarely ever occurring in acute organic disease, may generally be considered as characteristics of nervous irritation."

In the diseases of the spinal cord which have already been under consideration—spinal meningitis, myelitis, spinal congestion, and tetanus—it has been seen that it is the rule for the spine *not* to be tender on pressure, and in spinal irritation it has been seen that such tenderness is so constant as to deserve being reckoned as the distinctive feature. Here, then, is a point of difference which will serve as a guide to a correct diagnosis in several important cases in which guidance is necessary—which will serve as a guide in almost all cases except in that with which spinal irritation is most readily confounded. This case, which is strumous disease of the vertebræ, is one in which spinal tenderness is also present, as well as many other symptoms of spinal irritation—pain in the side, stomach, or bowels, cough, oppression, tightness around the waist, and so on—and in which relief is obtained by reclining. Nay, there may even be in spinal irritation a yielding and projection of the tender vertebræ, with some puffiness of the overlying skin, which simulates in no imperfect manner the earlier stage of angular curvature. There are many resemblances, in fact, but, as Dr. and Mr. Griffin have pointed out, there are also certain differences which are so well marked as not to leave the diagnosis in doubt. Thus it is found: "1st. That strumous disease of the vertebræ attacks the young, and most frequently those under the age of puberty, who are least of all liable to be affected by spinal irritation. 2d. That disease of the vertebræ, when attacking young girls, is seldom accompanied by symptoms of a purely hysterical character, while any serious irritation of the cord can scarcely exist without them. 3d. That an apparent prominence of the tender portion of the spine, which sometimes exists in case of irritation, is never strictly angular; for, if four or five of the vertebræ seem to project, the prominence is nearly equal in all, whereas in caries of the bones it is greatest in the middle, the prominence depending, in fact, on a slight puffing of the ligaments or investments of the spine, and not on displacement or curvature. 4th. That absolute paralysis of the lower limbs is a rare consequence of irritation, and a frequent one of caries of the bones. 5th. That the general health suffers less in the former complaint, and it is not attended with the look of serious organic disease which is indicative of the latter. 6th. That the constitution of the patient may also prove useful as a guide, the disposition to spinal irritation, as well as to scrofula being hereditary."

5. PROGNOSIS.—However urgent the symptoms may be, the prognosis in spinal irritation is favourable rather than unfavourable. It must always be borne in mind, however, that spinal irritation is a state which may issue in inflammatory or other organic changes in the cord or in its membranes, and that a favourable prognosis must be qualified by this contigency, especially in those cases in which there is some obvious vice of the constitution—scrofulous, gouty, rheumatic, syphilitic, or other.

6. TREATMENT.—"Local depletion by leeches or cupping," says Mr. Teale, "and counter-irritation by blisters to the affected portion of the spine, are the principal remedies. A great number of cases will frequently yield to the single application of any of these means. Some cases, which have even existed for several months, I have seen perfectly relieved by the single application of a blister to the spine, although the local pains have been ineffectually treated by a variety of remedies for a great length of time." Of the efficacy of blisters in these cases I have had abundant proof. As to the good effects of local depletion I have had less experience, partly because I found that the blisters were sufficient of themselves, and partly because I believe that the state of irritation is associated with a state of capillary contraction and bloodlessness, and not with a state of capillary paralysis and congestion.

Still, I can well believe that there are many mixed cases in which irritation has issued in some degree of capillary paralysis and congestion, especially in the skin at the seat of spinal tenderness, and in which this state will be greatly relieved by local depletion.

As regards medicine, I should certaintly be disposed to trust most in common tonics—quinine, steel, or cod-liver oil; to the latter in conjunction with some preparation of phosphorus most of all, perhaps. And certainly I should be disposed to fight against pain and spasm, as I have sufficiently explained elsewhere, by remedies which rouse the circulation to greater activity, and not by those which have a contrary action. Nay, I should even have more confidence, as a local application for pain, in some application which would produce a hyperæmic condition of the skin, than in any one which had a deadening effect upon the sensitiveness of the part.

It is, no doubt, an indispensable part of the treatment to avoid standing or walking to the extent of producing fatigue, but there would seem to be no necessity, except as a very temporary measure, perhaps, to insist upon a recumbent position being retained for any length of time. Upon this point Mr. Teale says (and he says all that need be said), "When my attention was first directed to this subject, I considered recumbency a necessary part of the treatment: it is, for a moderate length of time, undoubtedly beneficial, and frequently very much accelerates recovery; but subsequent observation has convinced me that it is by no means essential. I have seen several instances of the most severe forms of these complaints, occurring in the poorer classes of society, where continued recumbency was impracticable, which have, nevertheless, yielded without difficulty to the other means of the treatment, whilst the individuals were pursuing their laborious avocations."

As regards diet I have only this to say—that I believe the great thing to be done is to supply wine or some other alcoholic drink as well as nutritious food in sufficient quantity. I believe that nutritious food in itself is not enough. In very many cases it it found that alcoholic drinks are either abstained from altogether or taken in very insignificant quantities from a fear that they will aggravate the pain or spasm, or for some other reason: in very many cases it is found also that relief is obtained only when this practice is abandoned, and the diet made to include at least an average share of the drinks in question. Indeed, the result of my own experience is unequivocal in this respect —that the somewhat bold use of alcoholic drinks is a cardinal point in the treatment of spinal irritation, and that this indication must be fully acted upon if this treatment is to lead to anything like satisfactory results.

Of the spinal maladies remaining to be noticed the principal are these: General spinal paralysis, hysterical paraplegia, reflex paraplegia, infantile paralysis, hemorrhage, non-inflammatory softening, induration, atrophy, hypertrophy, tumour, concussion, compression, caries of the vertebral column, spina bifida, &c.

VI. General Spinal Paralysis.

There is a form of general paralysis to which Dr. Calmeil gave the name of general paralysis of the insane, and with which all who know anything of insanity are sufficiently familiar. It may coexist with any form of insanity, but it is most commonly associated with the monomania in which the patient believes himself to be possessed of superhuman power and unbounded opulence. The first signs are likely to be thickness of speech, quivering of the lips and tongue, fumbling and clumsy movements of the fingers, with an unsteady and sidling gait. Then the urine escapes now and then involuntarily, or even the feces. Once begun, the downward course of the malady is headlong, and in a few months, in a few weeks it may be, within two or three years at the most, the patient is in bed, altogether without the power of supporting himself on his feet, unable to use his hands so as to help himself in any way, incapable even of turning over in bed much less of sitting up, requiring to be fed like a child, and, when fed in no small danger of choking if left to masticate the morsels, with urine and feces escaping under him unheeded, and with every power of body and mind an utter wreck. With few exceptions the thickness of speech shows that the muscles of the tongue and lips are the first to fail, but in fact all parts of the muscular system show signs of weakness about the same time, and it is difficult to fix upon any one part and say that it is affected before the rest. Sometimes, the paralyzed muscles become considerably atrophied, but the rule appears to be that such atrophy is less marked than in cases where the paralysis is the result of disease in the spinal cord: always, according to Dr. Duchenne, the paralyzed muscles, whether atrophied or not, retain their full share of electric contractility. After death signs of disease are found in the brain, but not in the spinal cord; these signs being increased vascularity, with serous or sero-fibrinous infiltration in the pia mater, in the cortical substance, and in the brain structure generally.

General spinal paralysis is the name used by Dr. Duchenne to describe a form of paralysis which, until he pointed out the differences, was confounded with general paralysis of the insane. Looking hastily at the phenomena of paralysis when clearly developed, it is, indeed, not to be wondered at that these two disorders should have been confounded; but in reality general spinal paralysis, as defined by Dr. Duchenne, possesses peculiarities which are sufficiently characteristic. In general spinal paralysis the mental faculties are natural; in general paralysis of the insane they are fundamentally deranged. In general spinal paralysis the electric contractility of the paralyzed muscles is abolished or greatly impaired; in general paralysis of the insane it is intact. In general spinal paralysis the paralysis usually begins in the legs and travels upwards, often remaining in the lower parts of the body a long time before attacking the tongue, face, and upper extremities: in general paralysis of the insane all parts of the muscular system would seem to be affected simultaneously, or, if there be any difference as to time, it is the tongue and the upper parts of the body which are the first to suffer. In general spinal paralysis there is a marked disposition to atrophy in the paralyzed muscles and elsewhere, to bed-sores, and to other signs of defective nutrition; in general paralysis of the insane these evidences of wasting are, to say the least, far less conspicuous. In general spinal paralysis the progress of the disease is slow, often extending over several years; in general paralysis of the insane the whole course of the disease is comprised within three or four years at most. In general spinal paralysis the post-mortem signs of disease are in the spinal cord and not in the brain; in general paralysis of the insane the reverse of this obtains, the cord being healthy and the brain the seat of disease. Much, no doubt, remains to be done before it is possible to speak positively as to the character of the diseased changes in the cord which are met with in general spinal paralysis; and at present it must suffice to say, that in one case related by Dr. Duchenne there was softening and injection of the anterior columns in the cervical region of the spinal cord, and that in one case which I had the opportunity of examining, there was want of proper consistence, not exactly amounting to actual softening, and a perceptible degree of atrophy, in these columns throughout the whole of their course from the middle of the neck downwards. Whether general spinal paralysis will prove to have that relation to disease of the anterior columns of the cord which locomotor ataxy has to disease of the posterior columns, remains to be seen.

General spinal paralysis blends, no doubt, with other spinal diseases, and its symptoms vary accordingly; but still it occurs with sufficient frequency in the form described by Dr. Duchenne to deserve the position which he assigns to it as an individual malady. There are also relations equally intimate between general spinal paralysis and cerebral maladies, and I am very much disposed to think that the cases in which the mental powers are obviously weakened will be found to be at least as numerous as those typical cases in which these faculties are natural. At the same time, it must be borne in mind that in some cases of general spinal paralysis the mind may seem to be weakened, when in reality it is not so—that in some cases there may be an air of stupidity, or even fatuity, arising from the slow play of the features, the thickness of the speech, the fumbling of the fingers, and like symptoms, which air has its origin in the paralyzed state of the muscles and not in the enfeebled state of "the man behind the mask."

General spinal paralysis cannot be confounded with local Cruveilhier's atrophy, or lead palsy, and it must not be confounded with the general forms of these maladies. In general Cruveilhier's atrophy, as well as in local, the atrophy of the muscles is partial, certain muscles being, as it were, dissected out, and others left untouched, capriciously; in general spinal paralysis the atrophy is *en masse*. In general Cruveilhier's atrophy, what remains of muscle obeys the will and reacts with electricity properly—there is no paralysis; in general spinal paralysis there is true paralysis, and the paralyzed muscles have lost their electric contractility. In general lead palsy, also, the history will be sufficient to prevent any confusion as to diagnosis—the paralysis at first electing the extensor muscles of the forearm, the blue line upon the gums, the colic, the constipation, the possibility of lead contamination, and so on.

As regards treatment there is nothing to be said except that it must be conducted upon the same principles as those which apply in analogous cases.

VII. Hysterical Paraplegia.

Paralysis is certainly entitled to a place among the symptoms of hysteria. Dr. Briquet met with it in 113 out of 430 hysterical patients, its seat being in the four extremities and in the principal muscles of the trunk in 6, in the left arm and leg in 46, in the right arm and leg in 14, in both arms in 5, in the left arm only in 7, in the right arm only in 2, *in both lower limbs in* 18, in the left lower limb in 4, in the feet and hands in 2, in the face in 6, in the larynx in 3, in the diaphragm in 2; and my own smaller experience is more in harmony with these statistics than with the statement of Todd, that the face and tongue escape in hysterical paralysis, that the hemiplegic form of paralysis is less common than the paraplegic, and that "hysterical aphonia" is the form which is most frequently met with.

Hysterical paralysis, so called, is generally met with in persons of a nervous habit of body, and in conjunction with symptoms of an unmistakably hysterical character. As a diagnostic feature, Todd laid stress on a peculiar expression of countenance, which he denominated *facies hysterica*—an expression characterized by a remarkable depth and prominent fulness, with more or less thickness, of the upper lip, and by a peculiar drooping of the upper eyelids, and, as it would seem, with good reason. Often, moreover, there is a definite history of symptoms which clearly come within the category of hysterical phenomena—emotional excitability, globus, plentiful gushes of pale urine, and the rest. In diagnosing hysterical paralysis, however, it is not necessary to trust solely, or even chiefly, to evidence such as this, for the paralysis itself is found to have certain features which in themselves are sufficiently distinctive.

Hysterical paralysis is characterized by the paralysis being more or less incomplete, by a marked degree of numbness being associated with it, and chiefly (according to Dr. Duchenne) by the paralyzed muscles, which are not wasted, *having lost their electro-sensibility without losing their electro-contractility*—a loss which, by the way, does not support Sir Benjamin Brodie's opinion that it is the power to will contraction, and not the power of executing the orders of the will, which is at fault in this form of paralysis.

It would also seem to be a peculiarity of hysterical paralysis, as well as of hysterical hyperæsthesia, anæsthesia and clonic convulsion, to affect the *left* side of the body rather than the right. Thus, M. Briquet found pleurodynia nineteen times, hyperæsthesia and anæsthesia five times, clonic convulsion twice, and paralysis thrice as frequent on the left side as on the right side. He found, indeed, a state of things which presents a contrast to what is met with in rheumatism, neuralgia, pleurisy, pneumonia, and other maladies, in all of which it is the right side of the body which is most prone to suffer.

Very frequently, I believe, hysterical paralysis is preceded by symptoms which come under the head of spinal irritation, and not unfrequently, especially when the upper part of the body is affected, it is ushered in by emotional and other symptoms which may at times deserve to be spoken of as an attack of hysteria.

Hysterical paraplegia agrees in its essential features with other forms of hysterical paralysis. The paralysis is usually incomplete. Numbness of the paralyzed parts is a conspicuous phenomenon; as conspicuous, it may be, as the paralysis. The paralyzed muscles have lost their electro-sensibility without losing their electro-contractility. The bladder and bowel (as much apparently for want of proper sensibility as from true paralysis) are little under control, if at all; less so, as a rule, than in common paraplegia. The paralysis is often preceded by symptoms of spinal irritation, in the lumbar region especially—spinal tenderness, pains about the pelvis and in the legs, irritability of the bladder, and the rest; and now and then it is ushered in by some ordinary hysterical disturbance of one kind or other. And where one leg only is affected, there would seem to be, as Todd pointed out, a gait which is not less characteristic than that which is seen in common hemiplegia. In common hemiplegia the trunk in walking is first of all inclined to the sound side, and the whole weight of the body made to rest upon the sound leg, and then the paralyzed limb is raised from the ground and thrown forwards by swinging it outwardly; the whole series of movements being very like those which are necessary in walking with a wooden leg. In hysterical paralysis, where one leg only is affected, the paralyzed limb, instead of being raised from the ground, as in common hemiplegia, and thrown forward by an outward swing, is dragged directly forward, with the foot trailing on the ground.

The prognosis in hysterical paralysis would always seem to be favourable. Sooner or later, in one way or another, a cure is brought about, most tardily; perhaps, in the paraplegic form of the disorder.

As regards treatment, all that need be said is, that general rules must be followed out, and that, if anything special has to be done, most help will probably be derived from sharp faradization with electrodes which allow the currents to act on the sentient nerves rather than on the muscles—that is, with metal ends rather than with the moistened sponges commonly used. At any rate, sharp practice of this kind has often served to bring about results as sudden and satisfactory as those which have now and then followed the exercise of faith in the power of St. Médard and other kindred agencies.

VIII.—REFLEX PARAPLEGIA.

Paraplegia is one of the consequences of primary disease in the spinal cord: of this there can be no doubt. Paraplegia may also be the result of disorder or disease beginning at a distance and affecting the cord secondarily—beginning in the urinary and genital organs more especially: of this there can be but little doubt. In the former case the paraplegia is spoken of as centric; in the latter as eccentric or *reflex*.

The chief characteristics of that form of reflex paraplegia which is associated with disease of the urinary organs—*urinary paraplegia*, as it is often called—the commonest and most important of all the forms of reflex paraplegia, as it certainly is, are these; or at any rate these are those upon which Dr. Brown-Séquard, who has paid much attention to this subject, insists. Usually the paralysis is incomplete both as to degree and extent, some muscles being obviously more affected by it than others. Usually the paralysis is *not* associated either with tingling, or numbness, or anæsthesia. Usually the bladder and rectum are only slightly implicated in the paralysis. Usually there are changes for the better or the worse in the degree of paralysis corresponding to changes for the better or worse in the disease of the urinary organs. Usually there is no marked atrophy in the paralyzed muscles. Not unfrequently a cure or marked amelioration in the paralytic condition is brought about by the removal of the disease in the urinary organs. Dr. Brown-Séquard indicates these as the chief characteristics of reflex paraplegia connected with disease of the urinary organs, and of other forms of reflex paraplegia as well, the only difference in the description of these latter forms of disease being the substitution for the term urinary of the name which indicates the starting-point for the paralysis.

Thus defined, reflex paraplegia differs diametrically from the paraplegia produced by myelitis. In paraplegia from myelitis the paralysis is usually complete, and all the muscles are affected equally: not so in reflex paraplegia. In paraplegia from myelitis the paralysis is associated with tingling, numbness, or anæsthesia: not so in reflex paraplegia. In paraplegia from myelitis paralysis of the bladder and lower bowel is a marked phenomenon: not so in reflex paraplegia. In paraplegia from myelitis the paralyzed muscles are usually atrophied and degenerated: not so in reflex paraplegia. In paraplegia from myelitis cure, or even improvement, is the exception: in reflex paraplegia it is the rule.

It is, indeed, easy enough to find marked differences between paraplegia from myelitis and reflex paraplegia: but the case is far otherwise when a comparison is instituted between paraplegia from spinal congestion and reflex paraplegia. In reflex paraplegia the paralysis is incomplete, and all muscles are not affected equally: in paraplegia from spinal congestion it is so also. In reflex paraplegia the paralysis is not associated with tingling, numbness, or anæsthesia: in paraplegia from spinal congestion it is the same, with the single exception, that there may be at one time or other a trifling degree of tingling at the extreme tips of the fingers or toes. In reflex paraplegia there are fluctuations in the degree of the paralysis: so also in paraplegia from spinal congestion. In reflex paraplegia there is no marked change in the nutrition of the muscles: so also in paralysis from spinal congestion. And, lastly, in reflex paraplegia, as in paraplegia from spinal congestion, a cure is neither an impossible, nor even an improbable event. As to essential characteristics, indeed, I can find marked differences when reflex paraplegia is compared with paraplegia from myelitis, but none when reflex paraplegia is put in comparison with paraplegia from spinal congestion.

Nor is reflex paraplegia *always* to be distinguished by being obviously *preceded* by eccentric disorder in the urinary organs or elsewhere. It is, indeed, as Dr. Gull has well pointed out, "not always easy to determine at this point whether symptoms have a central or a peripheral origin . . . . There is, perhaps, no fact to be more insisted upon than the normal dependence of the sympathetic upon the integrity of the spinal system. As a result of this dependence we learn that dyspepsia, vomiting, constipation, colic, vesical catarrh, prostatic irritation, pains in the joints, and many other peripheral disturbances, may seem to precede the central malady, and to be the cause of it, when in truth they are its effects." And again: "It is no new fact in medicine, that cerebral exhaustion may impair the functions of the cord (especially of the lower segments), and give rise to precisely those symptoms which have been set down as pathognomonic of urinary paraplegia."

Dr. Brown-Séquard has taken a very different view of reflex paraplegia to that which is here taken. He regards this disorder as due, not to spinal congestion, but to a state of the circulation diametrically opposed to this. He believes that a state of irritation, commencing eccentrically, is propagated along the vaso-motor nerves, of which the result is, primarily, contraction of bloodvessels in, and secondarily, exclusion of the due amount of blood from, one or more of the three parts following—the spinal cord, the nerves proceeding to or coming from the cord, the muscles. He believes that the proper activity of the nervous tissue or muscle is starved into paralysis for want of blood; and he founds this view on the fact that a state of irritation in the vaso-motor nerves may proceed from a distant point and produce contraction of the vessels, and upon the fact that traces of organic disease are wanting after death in many cases of reflex paraplegia. The argument, indeed, is all but as conclusive as it is masterly and original. The same evidence, however, admits of a very different construction, and that even without anything like special pleading. It is, no doubt, true enough that a state of irritation in vaso-motor nerves may lead to contraction in bloodvessels and thereby exclude a due amount of blood from the part to which these vessels belong; but it is not less certain that the same state of irritation carried beyond a given degree, either in time or in intensity, may, by paralyzing the vaso-motor nerves, lead to relaxation of vessels, and, thereby, to the admission into them of an undue amount of blood. Moreover, it may also be assumed, as a thing by no means improbable, that the contraction of the coats of the relaxed and paralyzed vessels in rigor mortis may prevent any marked traces of such vascular engorgement being met with after death: at any rate it is impossible to infer from the absence of such traces of congestion after death, that there was no such congestion during life. Indeed, the evidence adduced by Dr. Brown-Séquard in favour of his theory of reflex paraplegia is in itself insufficient to decide whether his view or that which I venture to put in opposition to it is the correct one, for in reality it may be used equally in support of either view. And certainly it would seem to be a collateral objection to the view which connects reflex paraplegia with a state of capillary contraction and comparative bloodlessness brought about by irritation in vaso-motor nerves, that in states where the whole nervous system is in a state of great irritation, as in tetanus, and in the state specifically designated spinal irritation, and where it may be assumed that the vaso-motor nerves participate in this state of irritation, and produce vascular contraction and comparative bloodlessness in the spinal cord and elsewhere, that paraplegia or any form of paralysis is precisely the symptom which is not present. Moreover, Dr. Gull makes some remarks on urinary paraplegia which have an important collateral bearing on the subject in hand, and which tend in no ordinary degree to support the conclusion to which all the previous considerations tend: "If," he says, "we regard the nature of the urinary disease which most commonly leads to paraplegia, we shall find that it is an inflammation, either in the prostate, bladder, or kidneys; and we shall also find, that it is only after chronic inflammation has lasted a long time that the paraplegic weakness supervenes. It is in just those cases where there is most irritation, and but little inflammation, that paraplegia does not occur. Uric acid and oxalate of lime calculi may cause hæmaturia and any amount of irritation, but unless *suppurative* inflammation set in, paraplegia is not produced. A review of all the recorded cases of urinary paraplegia will show that it is the *inflammatory* condition of the urinary organs which leads to paralysis, and not one of irritation."

In speaking in this manner, however, I do not wish to confound reflex paraplegia with spinal congestion. On the contrary, the more I see of practice the more I am disposed to think that there is a reflex variety, not only in paraplegia from spinal congestion, but in every form of paraplegia; that, in fact, the causes at work in producing all spinal maladies are reflex in their character as well as centric, reflex, it may be, rather than centric.

If the true view of reflex paraplegia be the one which is here taken, it follows that the treatment of that form of this disorder which is defined by Dr. Brown-Séquard will be substantially the same as the treatment of paraplegia from spinal congestion, and not that which has been recommended on the supposition that the spinal cord is starved for want of blood in consequence of its vessels being kept in a state of contraction by irritation of the vaso-motor nerves. Nay, even the necessity to treat eccentric disorder or disease in the urinary organs or elsewhere can scarcely be considered a peculiar feature in the treatment of reflex paraplegia; for, in fact, it is always an essential part of any sound plan of treatment in any disease of the spinal cord, whether originating in the cord or at a distance from the cord, to make a point of doing everything to remove or mitigate any eccentric malady. It is always necessary to do this, because an eccentric malady, whether primary or secondary to the spinal disorder, or whether having no other than a purely accidental relation to this disorder, invariably *reacts* prejudicially upon the cord. This eccentric malady must of course be dealt with on general principles, this thing or that being done according as irritation or inflammation may happen to be the predominating condition. In urinary paraplegia, for example, it is very possible that the local application of opium, or belladonna to the urethra, as recommended by Dr. Brown-Séquard, may be of much use; this is very possible on any hypothesis: but with respect to the frequent introduction of catheters, with a view to relieve irritation, I think it is difficult to come to a different conclusion to that which Dr. Gull has arrived at. "This course," says this able physician, "is not unattended with danger. There is no part of the treatment which calls for more discrimination. The diseased textures and veins about the neck of the bladder are so prone to suppuration, that the catheter is often a fatal weapon. The few scattered instances, such as that recorded by Dr. Graves, where immediate good effects have followed, have had undue influence towards promoting mechanical interference. Carefully considered, they do not warrant the inference drawn from them. If the urinary passages are so contracted that the bladder cannot empty itself, the catheter is obviously required; but it must be simply prescribed on these grounds. The rule for its use is the same as in the treatment of the aural passages, when the middle ear is diseased. If there be a free exit for the excretions, the less mechanical interference the better. As meddlesome midwifery is bad, so is the meddlesome employment of the catheter in urinary paraplegia. Cases might be quoted where a fatal issue has been induced by the meddlesome interference with a diseased bladder, under the hope of removing some hypothetical cause of reflex irritation."

IX.—INFANTILE PARALYSIS.

This disorder, to which attention seems to have been directed first of all by Underwood, Marshall Hall, and Kennedy, is the *paralysie* (*dite essentielle*) *de l'enfance* of several French writers. It attacks children indiscriminately, without any regard to sex, between the age of six months and two years, at the time of the first dentition more especially; and it is the grand source of shrivelled, half-dead limbs, club-feet, and other sad deformities.

Mr. William Adams, who has had ample opportunities of becoming practically acquainted with the history of infantile paralysis, and whose account of this disorder is more to the point than any other with which I am acquainted, indicates these as the most trustworthy characteristics: 1. The paralysis is usually partial, single muscles or groups of muscles only being affected. 2. The sensation in the paralyzed parts is usually perfect, or all but perfect. 3. The bladder and lower bowel are usually not distinctly implicated in the paralysis. 4. The paralyzed muscles are at no time rigid. 5. Great improvement or complete recovery is the rule, and not the exception. The paralysis is usually neither accompanied nor preceded by "head symptoms."

The onset of the disorder is generally sudden and unexpected. The child is put to bed well, and in the morning it is found to be paralyzed. Or the paralysis may be grafted upon some marked febrile disorder, as gastric or remittent fever, measles, or typhus; or upon some other malady, as hooping-cough and pneumonia. In some cases there may be transitory and trifling feverishness at first, but fever is certainly no essential accompaniment at any time. Now and then, but only in exceptional cases, the disorder may be ushered in by convulsions or drowsiness.

The paralysis has usually a wider range at first than that which it takes afterwards; in other words, the paralysis is more or less general at first, and more or less localized afterwards. Thus it is a common thing for all the limbs to be attacked and for only one leg to remain paralyzed, or, rather, to remain partially paralyzed, for there is a certain degree of recovery in certain muscles, even in the worst cases. It is the constant rule, indeed, for recovery to be slower in the legs than in the arms, and in certain muscles than in others. Usually the disease does not mount high enough to paralyze muscles whose nerves are given off above the true limits of the spinal cord. There is certainly no loss of sensation in infantile paralysis. On the contrary, as Dr. West remarks in his admirable treatise on the diseases of infancy and childhood, "sensation in the affected limb appears to be exalted when the paralysis is recent, the degree of hyperæsthesia in the early stage being in such cases proportionate to the loss of power which afterwards is apparent." Moreover Dr. West proceeds to say, "In some instances the exaggerated sensibility continues for several weeks, though this is unusual; and when this is the case, the leg being the seat of the affection, and the paralysis incomplete, the existence of hip-joint disease may very likely be suspected. In such a case the child bears all its weight on the healthy limb, turns the foot of the affected side inwards when walking, and stands with the toes of that foot resting on the dorsum of the foot of the healthy side. Still it will usually be found that the exaggerated sensibility of the paralyzed limb varies greatly at different times, while that extreme increase of suffering produced in cases of hip-joint disease on striking the head of the femur against the acetabulum by a blow upon the heel, and the fixed pain in the knee of the affected side, so characteristic of diseases of the hip-joint, are absent; and these points of difference will enable you to distinguish between the two affections. One other important means of diagnosis is furnished by the presence or absence of an increased temperature over the suspected joint, the value of which easy observation in determining the presence or absence of inflammation about any particular spot is dwelt upon by Mr. Hilton in his lectures delivered recently at the College of Surgeons."

The peculiarities of infantile paralysis, so thinks Mr. Adams, point to a special pathology which has yet to be made out satisfactorily. As it seems to me, however, these peculiarities, instead of showing, as Mr. Adams believes, that infantile paralysis is unlike paralysis in adults, only show a close analogy to, if not an actual identity with, the paralysis which has been seen to result from spinal congestion. In infantile paralysis the paralysis is partial: in paralysis from spinal congestion it is the same. In infantile paralysis sensation is exaggerated rather than dulled in the paralyzed parts: in paralysis from spinal congestion it is the same. In infantile paralysis the bladder and lower bowel are obedient to the will: so also in paralysis from spinal congestion. In infantile paralysis the paralyzed muscles are limber, not rigid: so also in paralysis from spinal congestion. In infantile paralysis recovery more or less complete is the rule rather than the exception; so also, and very much in the same order, in paralysis from spinal congestion. In infantile paralysis "head symptoms" are exceptional phenomena at any time: so also in the paralysis from spinal congestion. Neither do I know of anything to invalidate the conclusion which those resemblances would seem almost to necessitate—that infantile paralysis, as defined by Mr. Adams, is nothing more than paralysis from spinal congestion.

Moreover, this conclusion is not discredited by the disclosures of morbid anatomy. There were no traces of organic disease either in the spinal cord or brain or nerves in the four cases of genuine infantile paralysis which were examined after death by MM. Barthez and Rilliet, Dr. Fliess, and Mr. Adams, all four most competent observers. The evidence supplied by these cases is indeed purely negative. Nor is evidence more positive to be found in the two cases examined after death by M. Laborde, the writer of a very able treatise on infantile paralysis recently published. In these two cases, without doubt, there were certain organic changes in the spinal cord and in some of its nerves, but these changes are plainly not essential to infantile paralysis as defined alike by M. Laborde and Mr. Adams, for the simple fact is, that the clinical history of these cases is not clearly that of infantile paralysis so defined. In a word, there is nothing in the scanty contributions of the dead-house to show that the very closest relations may not exist between the disorder under consideration and spinal congestion.

The duration of infantile paralysis is very variable. It may pass off in a few days, or even a few hours: it is more likely to occupy several weeks or months in this process of improvement. Improvement, to a greater or less degree, is indeed the rule, and not the exception; and it may even be said that the cases which stop far short of recovery are by no means common. Mr. Adams says, "It is generally supposed that, unless recovery takes place within a few months, the paralysis is persistent through life; but I have seen many cases in which improvement has proceeded, to a very useful extent, several years after the seizure;" and to the truth of this remark my own experience bears ample testimony. Indeed, I should say from what I have seen, that if the paralyzed muscles retain their electro-contractility and electro-sensibility, and so show that they have not passed into that state of fatty degeneration into which they always tend to pass eventually, there appears to be scarcely any limit to the time in which improvement, and even complete recovery, is possible.

The groups of muscles most frequently affected in infantile paralysis, according to Mr. Adams, are, 1. The muscles of the anterior part of the leg, forming the extensors of the toes and the flexors of the foot; 2. The extensors and supinators of the hand, these muscles being always affected together; and 3. The extensors of the leg, and with them generally the muscles of the foot, as in the first group. When single muscles are affected, the most likely to suffer are these: 1. The extensor longus digitorum of the toes; 2. The tibialis anticus; 3. The deltoid; and 4. The sterno-mastoid.

The deformities produced by infantile paralysis are most frequently met with in the feet and legs, because these are the parts most frequently affected; and the particular kind of deformity varies, of course, with the muscles involved in the paralysis.

"The most frequent kind," says Mr. Adams, "is that of (1) talipes equinus; and the other deformities occur in the following order—(2) equino-varus; (3) equino-valgus; (4) calcaneus, or calcaneo-valgus; and (5) talipes varus. When both feet are affected, equino-varus of one foot is generally found with equino-valgus of the other."

Mr. Adams is of opinion that the great cause of the deformities which are met with in infantile paralysis is the "adapted atrophy" of Mr. Paget, this change taking place chiefly in the opponents of the muscles which have suffered from paralysis. If, for example, the anterior muscles of the leg are paralyzed, the anterior portion of the foot drops, and the heel is raised, not by active contraction of the posterior muscles—for division or paralysis of one set of muscles does not excite active contraction in the opponent muscles—but in consequence of the position assumed by the foot from its mechanical relations with the leg.. Another cause of deformity is obviously atrophy and actual or comparative arrest of development in the paralyzed muscles; for, unless the paralysis soon passes off, it is plain that the muscles will not only waste, but be left behind in the rapid process of development which is everywhere at work in a young and growing child. Mr. Adams is also of opinion that the early and late rigidity of Todd and true spasm have very little to do in causing the deformities in question: and so it may be in the deformities connected with that form of paralysis to which he restricts the term infantile—that form which is undoubtedly the common variety of infantile paralysis, and which, as it would seem, is dependent on spinal congestion. It is very certain, however, that infants and children are liable to more than one form of paralysis, and that there are deformities associated with rigid as well as with flaccid muscles. It is very certain that this rigidity may be either "early" or "late," as distinguished by Todd, or even still more decidedly spasmodic than that form which is called "early rigidity." In a word, infantile paralysis is a designation as little to be defended as would be the term adult paralysis; for on inquiry it is found that in children, as in adults, there is more than one form of paralysis, and that all the forms which may happen in adults may be repeated in children. The form of paralysis which has been described as infantile is unquestionably the commonest, and the other forms are so uncommon as to be little more than exceptional; and this, in fact, is all that can be said to justify the notion that infantile paralysis is a definite disorder of the spinal cord peculiar to infants.

The treatment of the deformities, especially of club-foot, resulting from the so-called infantile paralysis, is a subject of much practical interest and difficulty. Mr. Adams says: "The probability of benefit in such cases by any surgical procedure seems scarcely ever to be entertained. The existence of paralysis is supposed to contraindicate any surgical interference; but, from these apparently hopeless and essentially incurable cases some of the most striking and most valuable results of surgery are obtained by a combination of surgical and mechanical treatment. Mechanical aid, alone, is frequently sought from the instrument-maker, but his art is powerless when any considerable amount of deformity exists; and it is only by a scientific combination of surgical and mechanical skill that much good can be effected. In all these cases the treatment essentially consists in the removal of existing deformities by tenotomy and mechanical means, and a subsequent compensation for the existing paralysis by mechanical support, varying in different cases according to the extent of the paralysis." And no doubt very satisfactory results are obtained by those means. At the same time it is certain that in many cases very satisfactory results may be obtained without tenotomy, and without apparatus, by means used with the view of bringing back power into the paralyzed muscles—electricity,[1] movements of various kinds, shampooings, and others; and my own experience has convinced me that this fact is not yet sufficiently recognized and acted upon in practice. That in many cases neither tenotomy nor apparatus can be dispensed with I fully believe: that in all cases the electrical and gymnastical parts of the treatment are of primary rather than of merely secondary importance I am every day more and more convinced, because every day I meet with instances of muscles which I should once have looked upon as hopelessly paralyzed being resuscitated by those means. Indeed, I cannot but think that so long as institutions specially set apart for orthopædic purposes are wanting in properly furnished electrical rooms and gymnasiums, there must be in some essential points a necessity for a great reformation in orthopædic practice.

X.—HEMORRHAGE.

Blood may be effused into the substance of the cord between the arachnoid and pia mater, into the sac of the arachnoid, between the dura mater and arachnoid, or between the dura mater and the osseous canal—anywhere in or about the spinal cord, in fact. Hemorrhage in the substance of the cord, the *hœmatomyêlie* of Ollivier, may be a consequence of myelitis, the bloodvessels breaking up in the softening of the cord, and so allowing the blood to escape. It was so in the acute case which I took as my text when speaking of myelitis, for here the blood was collected at one point in the softened nerve matter to an extent which at first sight suggested the idea of hemorrhage into the cord rather than that of myelitis. Hemorrhage under or upon the spinal membranes, the *hœmatorachis* of Ollivier, may be a consequence of cerebral hemorrhage, the blood overflowing from the cranial into the spinal cavity, and perhaps mixing with the spinal fluid; or it may result from spinal congestion, spinal meningitis, myelitis, tetanus, hydrophobia, and certain other maladies. All these cases, however, are so uncommon as to be little more than exceptional. In fact, hemorrhage either into the substance of the cord, or under or above the spinal membranes, except as the result of some accidental injury to the spine, as in death by hanging, or in cases of still-birth where it has been necessary to employ much force to bring about the delivery, is, to say the least, a very uncommon affection.

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[1] There are certain forms of paralysis in which the paralyzed muscles do not react to the most powerful induced electric currents, but react energetically to a galvanic current of low tension, slowly interrupted (the *labile current* of Remak). The diagnostic and therapeutic bearings of this fact have yet to be worked out, but so far the therapeutic promise is good. The phenomenon in question has been already observed in several very different cases—in facial palsy (first noted by Baierlacher), in certain cases of infantile paralysis (discovered by J. Netten Radcliffe, of London, and Hammond, of New York, independently of each other), in certain cases of local palsy, *e. g.*, palsy of the extensors of the forearm and of other muscles, from lead poisoning (Bruckner and J. N. Radcliffe), in paralysis of the deltoid, not from lead (J. N. Radcliffe), in certain cases of muscular atrophy (J. N. Radcliffe), and in paralysis from traumatic injury of a nerve (Bruckner).

The symptoms of spinal hemorrhage are by no means clearly marked. Sudden and acute pain in the spine at the seat of the effusion, and sudden paralysis and loss of sensation, more or less complete, in the parts below this point, appear to be the chief symptoms where extensive hemorrhage has taken place into the substance of the cord. Sudden and acute pain in the spine would also seem to be a prominent symptom in hemorrhage below or above the spinal membranes, but not sudden paralysis and anæsthesia. In this latter case, indeed, instead of paralysis there have been some convulsive or spasmodic symptoms, and instead of anæsthesia some hyperæsthesia. In some cases, as in one quoted by Dr. Copland, the pain may not be in the back, but at a distance from the back; and in other cases, and this not unfrequently, pain may be greatly masked by the shock of the accident which has caused the hemorrhage, or by the shock attendant upon the laceration of the spinal cord by the effused blood. When the hemorrhage is in the medulla oblongata, and high up in the cord, the symptoms may be rather like those of epilepsy than anything else —loss of consciousness, convulsion more or less general, choking noises, and the rest—and this equally whether the blood is effused into the substance of the cord or around it; and this fact suggests the possibility, to say the least, that the convulsive or spasmodic symptoms, which have by some writers (on what to me seem to be insufficient grounds) been supposed to distinguish hemorrhage under or above the spinal membranes from hemorrhage into the substance of the cord, may in reality be due to irritation transmitted to the medulla oblongata and upper part of the cord, and not to irritation acting upon the membrane or membranes. Moreover, when the hemorrhage is high up in the cord priapism and distress of breathing are found to figure conspicuously among the symptoms, as they do also in other cases where this part of the cord is damaged by disease or injury. In a few instances, the symptoms of spinal hemorrhage are preceded by symptoms indicative of spinal congestion, or inflammation, or irritation.

Remains of old apoplectic cysts, similar to those so often found in the brain, have been met with in the spinal cord, even in the medulla oblongata and upper part of the cervical region; but these signs of partial recovery are, to say the least, altogether exceptional. Indeed the mischief done by the hemorrhage is generally not only irreparable, but very speedily fatal, and that too in spite of everything that can be done to promote recovery.

XI.—NON-INFLAMMATORY SOFTENING.

Two well-marked varieties of softening of the spinal cord are detected by the naked eye—the red and white. In both varieties the microscope brings to light broken-down nerve tissue mixed up with a number of bodies known as *granule masses*—large bodies, whose principal constituent is fat; black looking, from not transmitting light; and somewhat like mulberries, from being built up of a number of round bodies or granules. "It was once thought," said Dr. Wilks, "that these masses denoted inflammation. But you find them in any degenerating part, as a decaying strumous gland, or a cancerous tumour, or a phthisical lung: and the question of their formation in the brain or cord is not yet answered; whether they originate in inflammatory cells, or are the natural cells of the nerve structure degenerated. In some you may still see a wall and a nucleus, which points to the former opinion as the more correct." The red variety of softening is often in parts yellow rather than red: the redness being due to increased vascularity or effused blood corpuscles, one or both; the yellowness to the presence of fibrillated tissue, nucleated fibre, pus corpuscles, or some other form of distinctly inflammatory product. In a word, there can be no doubt of the inflammatory origin of the red variety of softening. In the white variety of softening, on the other hand, there are generally an atheromatous state of the vessels and other signs of true degeneration, the vascularity is evidently diminished, and there is an absence of those distinctly inflammatory products which have just been enumerated. It would seem, indeed, that the white variety of softening differs essentially from the red, in that, instead of being the result of inflammation, it is brought about by the parts being starved and atrophied for want of blood. With respect to the reality of these differences between these two varieties of softening there appears to be little or no reason for doubt: at the same time it must not be forgotten that it is not always easy to draw the line between these two varieties, and that they both may exist together in the same cord.

The symptoms of non-inflammatory softening would seem to be identical with those of the more chronic forms of myelitis. The more tardy the development of these symptoms, and the older the patient in years or in constitution, the more likely is the case to be one of non-inflammatory softening: and this is all that can be said in the matter of diagnosis. Practically, however, this want of definiteness is of no moment; for in the chronic form of myelitis the degenerative process has more to do in bringing about the diseased changes in the cord than the inflammatory, and more to do also in supplying the indications for treatment. Nay, it may even be held that the same remark applies to some extent to the more acute forms of myelitis as well as to the more chronic, for it is with the ruin rapidly produced by the inflammation rather than with the inflammation itself that the practitioner in medicine has to cope almost, if not altogether, from the very onset of the disease.

XII.—INDURATION.

Like the opposite condition of softening, induration (sclerosis) of the spinal cord is one of the consequences of myelitis, chronic or acute; of the chronic form more especially. Induration of the cord is generally associated with atrophy—atrophy often more marked in the white matter than in the gray—and with a condition so curiously bloodless that a section is not unlike that of white of egg boiled hard. In its highest degree the cord may have a leather-like or fibro-cartilaginous hardness and consistency. Induration is a much less common change than softening: it has no symptoms by which it can be distinguished from softening: and it is often met with when it was not expected, and under very different circumstances, as after acute myelitis on the one hand, or after long-standing epileptic disease on the other.

XIII.—ATROPHY AND HYPERTROPHY.

Atrophy of the spinal cord, like atrophy of the brain, is one of the changes which must be looked upon as natural to old age. In elderly persons, indeed, the cord becomes shorter and narrower and firmer, the spinal fluid increases in quantity, so as to fill the space left vacant by the shrunken cord, and the spinal nerves are sensibly wasted at both their roots. All this has been abundantly proved by Chaussard, Ollivier, and others. Atrophy, more or less general, is also associated with many forms of paralysis in which the cord has been long left in a state of comparative functional inactivity; and local atrophy is one of the consequences of tumour, displaced vertebræ, or anything which exercises pressure upon the cord. Of partial forms of atrophy resulting from disease, the only one about which there is any certain knowledge is that which is associated with the disease called locomotor ataxy—namely, atrophy of the posterior columns; and about this form enough has already been said in a separate article.

In a few instances the spinal cord has been found to be so much enlarged, apparently by a true hypertrophy of its natural tissues, as to occupy the whole space of the vertebral canal; but most generally what seems to be hypertrophy at first sight is due, chiefly at least, to congestive swelling and œdema. True hypertrophy has been met with in the fœtus: it occurs mostly in children: and it presents, so far as is known, no symptoms by which it can be recognized. Hypertrophy of the brain is a very uncommon affection, but it is common as compared with hypertrophy of the spinal cord.

XIV.—TUMOUR, &c.

"Tubercle and cancer," says Rokitansky, "are frequent in the brain, unfrequent in the spinal cord. Tubercle I have observed only in combination with other advanced tuberculoses. Its principal seat is the cervical or lumbar portion of the cord, where it sometimes occupies the white fibres, sometimes the gray substance. As in the brain, it leads to inflammation (red softening) and to yellow softening. I have never seen a tuberculous cavity in the cord. Sometimes several tubercles are grouped together, none exceeding the size of millet or hempseed; at other times only one exists, which is of large dimensions, equalling a pea or a bean. Exclusively of several cases of circumscribed callous induration of the white columns, as to the cancerous nature of which I am still in doubt, I have met with but one case of cancer of the cord. It was a solitary nodule of medullary cancer. Ollivier mentions several examples of diffused carcinomatous growths, as well as of the so-called colloid cancer. Among the entozoa I have repeatedly seen the cysticercus in the cervical portion of the spinal marrow. The acephalocyst sacs, as far as has been observed, have no connection with the cord; their nidus is even outside the dura mater. In one case the cyst forced its way into the cavity of the arachnoid."

Nor are exostoses, cartilaginous growths, or aneurisms frequently met with in positions which can exercise pressure upon the spinal cord. Cartilaginous growths, or rather bony plates, it is true, are not unfrequently met with in the visceral arachnoid of the cord—a condition which appears to be rarely met with in the brain; but these growths or plates can scarcely be brought under the head of tumours. Except, perhaps, in connection with scrofulous disease of the vertebræ, the pia mater of the cord is not the seat of tuberculous deposits; and here again is another point of difference between the pathological history of the spinal cord and the brain, for it is a well-known fact that the pia mater of the brain is a favourite seat of these deposits.

The symptoms produced by tumour vary greatly. Neuralgic pain in the back, over the seat of the tumour, appears to be an almost constant symptom. "Pain," says Dr. Reynolds, "is more marked in cases of carcinoma than of tubercle." If a particular nerve be irritated by the tumour, there may be pain, tingling, or some other anomalous sensation in the part or parts supplied by its sentient fibres, or some morbid form of contraction in the muscles supplied by its motor fibres. If a particular nerve be pressed upon more decidedly by the tumour, there may be local anæsthesia, or paralysis instead of morbid sensations or muscular contractions. It is but seldom, however, that these symptoms of irritation or pressure are so strictly localized; and in fact, the presence of the tumour is made known usually only by more general symptoms of irritation, or compression, or inflammation, which, instead of being in any way pathognomonic of tumour, may arise from many other causes. "There is, indeed," as Dr. Gull says, "no symptom, or single group of symptoms, which, taken alone, can serve as a secure basis for diagnosis." Tuberculous or carcinomatous deposits elsewhere, with signs of the peculiar dyscrasia of tubercle or cancer, aneurism elsewhere, nodes elsewhere, may help to a diagnosis by showing that symptoms which appear to point to a tumour may have such a cause, and at the same time may supply some information as to the special character of the tumour; but this possibility of help in diagnosis is too remote to be of much practical value, if any. It may be supposed that any scrofulous deposit in the cord is more likely to occur in children, and any cancerous growth in older persons; but even this rule has too many exceptions to make it of much use.

XV.—CONCUSSION.

Concussion of the spinal cord, like concussion of the brain, is the result of a fall from a height, a blow on the back, or some other accident, and its symptoms vary with the intensity of the shock. Sudden paralysis and loss of sensation, more or less complete, with some inability to pass water or to prevent the escape of flatus or feces, are the more special symptoms. Sudden and marked failure in the circulation and respiration, as shown by pallor, feebleness of the pulse, diminished temperature, slow and shallow breathing, and other signs of common shock are also associated with the more especial symptoms. Great pain along the spine or in some part of the spine has been considered as one of the symptoms of spinal concussion; but neither pain nor spasm are met with in the cases which I have examined; and Dr. Reynolds comes to the same conclusion, for, speaking of these cases, he says: "There is in them neither marked pain nor spasm." Indeed, in the majority of cases the patient is obviously rendered incapable of experiencing either pain or spasm by being *stunned.*

The symptoms of spinal concussion not unfrequently issue in those of spinal congestion, or myelitis, or spinal meningitis, or else death without any signs of reaction may be the result. Often, without passing into any definite disease, the cord, even after what might at first seem to be only a slight degree of concussion, may not recover its former power perfectly, the patient ever afterwards being weak in many respects, especially in his legs and bladder. Indeed, concussion of the spine sufficiently severe to produce at the time any marked degree of paralysis in the limbs and bladder and lower bowel, with loss of sensation, is certainly a very grave matter, and it may be questioned whether in such a case recovery is ever more than partial.

The appearances after death may present nothing unnatural, or they may be those of hemorrhage more or less extensive. It is very possible that the cases in which severe pain in the back was a symptom would prove, if *all* the *facts* were fully known, to be cases in which the symptoms of concussion were mixed up with those of hemorrhage: at any rate, there was hemorrhage in one case of spinal concussion in which pain in the spine was a conspicuous symptom, which case came under my notice not long ago. In fatal cases, in which the reaction after the concussion has issued in inflammatory and other changes in the cord, these changes will be met with after death; and if fracture or dislocation of the vertebræ was produced at the time of the concussion, the evidence of such injury will of course not be wanting.

XVI.—COMPRESSION.

When the spinal cord is compressed by a dislocated or fractured vertebra, by a tumour, by a bullet or in any other way, the symptoms will of course vary with the seat and degree of compression. The symptoms will, in fact, be as variable—for they will be the same—as those which are produced by experimental division of the parts compressed, and about which more than is convenient had to be said in the preliminary remarks. All, therefore, that is necessary here is to refer to those preliminary remarks for the information which may help to make the symptoms of compression intelligible, and, in passing, to express a hope that trephining or other operative procedures which have been recommended and practised in certain cases of spinal compression may not be altogether unjustifiable.

XVII.—Caries of the Vertebral Column.

This disease is usually limited to the bodies of the vertebræ and to the intervertebral substances, but sometimes it extends backwards to the arches and processes of the vertebræ as well. It commences, very generally, in the middle dorsal region, and, as generally, it does not extend beyond this region; but there is no part of the spinal column in which it may not begin, or to which it may not extend; it invariably, when sufficiently advanced, gives rise to "angular curvature," or projection directly backwards, of the diseased part of the spine, this deformity being due to the way in which the thinned and diseased bodies of the vertebræ become crushed in under the weight of the upper part of the body. In the great majority of cases caries of the vertebræ is an unmistakably strumous affection, being neither more nor less than tuberculous infiltration of the bodies of the vertebræ; and the changes in the bone are due to the melting down of this deposit rather than to any strictly inflammatory process.

The earlier symptoms of caries of the vertebræ are not at all well marked. Of these the most conspicuous must be reckoned—weakness in the back, generally in the dorsal region, with aching or pain, more or less severe, in the weak part, causing a disposition to lean forwards and to use the arms as props; some prominence of the spinous processes of the weak and painful part of the spine, with some puffiness of the overlying skin; a feeling of undue heat, or even burning, in the weak and painful and prominent part, which is not felt in other parts of the spine, when a sponge soaked in moderately warm water is passed down the spine; and a state of tenderness on pressure or percussion, which is equally restricted to the same weak and painful and prominent part. Afterwards, when the disease is more advanced, there are more marked symptoms, namely, these: unmistakable "angular curvature," the formation of abscess, slight hectic in the evening, a feeling of constriction around the waist, it may be, and still later, more or less paralysis of the legs, more or less loss of control over the bladder and bowel, and other symptoms indicative of secondary myelitis or spinal meningitis. Abscess may be one of the earlier symptoms preceding any obvious deformity, or it may not occur at all. In fact, abscess appears to be a symptom of strumous disease of the vertebræ exclusively, and not of the non-strumous variety of caries. When it does occur, which is certainly in the great majority of cases, there is usually some diminution of pain and other evidences of irritation. When it does occur, as is well known, it generally makes its appearance at a distance from the diseased vertebræ, most commonly as "psoas abscess" in the groins, but by no means exclusively in this form and locality. It is seldom that the spinal cord becomes *compressed* by the giving way of the bodies of the vertebræ in the progress of the disease; but sooner or later it almost constantly happens that the cord or its membranes opposite the diseased vertebræ become the seat of inflammatory changes, which changes, rather than the drain from an abscess, are indeed the reason why, in so many cases, sooner or later, caries of the vertebræ proves to be destructive to life.

The diagnosis between "angular curvature" from caries of the spine, and the curvatures forward, backward, and sideways, without other structural changes in the vertebral column than those of simple adaptation to the altered position, is not very difficult. These latter curvatures, in fact, want all the special and grave features which have been indicated as characterizing the former. Nor yet is the diagnosis difficult between "angular curvature" in its earliest stage and spinal irritation, with which it is sure to be associated, and with which there is certainly no small danger of its being confounded. This topic has been already touched upon when speaking of spinal irritation, and here it is enough to say that the occurrence of the symptoms which are present in the beginning of caries of the vertebræ (which are no other than those which may belong to simple spinal irritation), in children or youths of a manifestly scrofulous habit—at an age, that is to say, and in a habit, in which the symptoms of simple spinal irritation are not likely to be met with—are sufficient to do more than create a bald suspicion of the existence of disease of the vertebral column.

The prognosis of caries of vertebræ is always bad enough. A humpback is the best result to be hoped for. The end to be aimed at in treatment is, of course, to promote anchylosis of the diseased bones of the vertebræ by allowing them to fall together—by favouring, that is to say, the deformity which is inevitable by letting the back bend and not by trying to prevent it by keeping the back straight—and to keep up the strength in every way. But these are matters which I cannot touch upon without trespassing upon the domains of surgery, and I therefore leave them to those who are better able, and whose right it is to deal with them.

XVIII.—SPINA BIFIDA, &c.

The commonest congenital affection to which the spinal cord is liable is dropsy, or hydrorachis, and of this dropsy *spina bifida* is the variety most frequently met with, and of most practical interest. The spine is bifid in this disorder from the non-development or separation of the spinal processes and laminæ, and the consequence of this malformation is that an opening is left through which, very often, the dropsical fluid presses outwards, and distends in so doing the integuments and subjacent tissues into an hernial tumour. Very generally congenital hydrocephalus is associated with congenital hydrorachis. The fluid in hydrorachis is precisely of the same constitution and character as that which is met with in hydrocephalus: it varies in quantity from a few ounces to several pints: it accumulates between the arachnoid and pia mater, in the arachnoid sac, in the central canal of the cord, and even outside the dura mater, sometimes in one place, sometimes in another, sometimes in more places than one. The hernial tumour into which this dropsical fluid bulges outwardly varies greatly both in position and size, and in the condition of its coverings: it is almost invariably met with in the lumbar region, but it may be in any region: it is usually of the size of a walnut or orange, but it may be as large as a child's head, or even larger; it may be single or multiple: its bulk may vary considerably under different circumstances, or not at all, becoming, if it vary, fuller and more tense if the position of the child be made such as to cause the fluid to flow into it, emptier and flaccid if this position be altered so that this fluid may run out of it, or if pressure be made upon it so as to bring about the same result: it may swell during expiration and fall during inspiration: it may present distinct fluctuation or none at all; and the skin over it may be sound, thickened, inflamed, ulcerated, gangrenous, covered with tufts of hair, and so on. The dura mater and its lining of arachnoid membrane always enter into the composition of the coverings of the tumour, and these are the only constant elements in these coverings. In the lumbar region, the cord and its nerves, which are generally rudimentary, are out of the tumour altogether: in the cervical and upper dorsal region, on the contrary, it is no uncommon thing for the cord and its nerves to be adherent to the walls of the tumour.

In spina bifida the lower limbs are generally paralyzed as well as the bladder and lower bowel, and not unfrequently there is, in addition to the spinal deformity, deficiency of the abdominal walls, hernia of the bladder, imperforate anus, &c. But few cases recover, or even improve, death happening generally at an early period either in convulsions or from spinal inflammation, the immediate cause often being the bursting of the tumour: still there are cases on record in which life has been prolonged—and this too with tumours of no small size—not only for a few months, but for 17, 18, 19, 21, and even 50 years.

There is little to be done for the relief of spina bifida. Pressure on the tumour by means of an air-pad and suitable bandages can do no harm; and occasional punctures with a grooved needle, as recommended by Sir Astley Cooper, may be a justifiable measure. Even cures have resulted from a combination of these punctures with pressure. "All the plans of treatment," says Mr. Erichsen, "by which the tumour is opened and air allowed to enter it, are fraught with danger, and will, I believe, inevitably be followed by the death of the child from inflammation of the meninges of the cord and convulsions."

There are several other congenital affections of the cord, of which the best account is still to be found in the classical pages of Ollivier. The cord may be entirely absent (amyélie); or it may be imperfect (atelomyélie). Of the imperfect forms of cord there are several varieties. The upper part may be wanting, as in anencephalous and acephalous monsters. The cord may be bifurcated at one extremity or the other, at the upper extremity in monsters with two heads and one body, at the lower extremity in monsters with one head and two bodies. It may be double. It may vary greatly in dimensions, being larger or smaller, longer or shorter than natural—longer, for example, in monsters with tails, shorter in monsters of a contrary sort. It may, as in one form of hydrorachis, be little more than a long bag in consequence of the distension of the central canal of the cord with the dropsical fluid. Or it may be discoloured, as it is in the state which Ollivier designates *kirronese* or *coloration ictérique.* These malformations or morbid conditions, however, are of theoretical rather than of practical interest: and therefore they do not form fit subjects for further notice in an article like the present, which has solely a practical end in view.

II.

EPIDEMIC CEREBRO-SPINAL MENINGITIS.

BY J. NETTEN RADCLIFFE.

DEFINITION.—An acute, epidemic disease, characterized by profound disturbance of the central nervous system, indicated, at the outset, chiefly by shivering, intense headache or vertigo, or both, and persistent vomiting: subsequently by delirium, often violent, alternating with somnolence, or a state of apathy or stupor; an acutely painful condition with spasm—sometimes tetanoid—of certain groups of muscles, especially the posterior muscles of the neck, occasioning retraction of the head; and an increased sensitiveness of the surface of the body. Throughout the disease, there is marked depression of the vital powers; not unfrequently collapse: and in its course an eruption of vesicles, petechiæ, or purpuric spots, or mottling of the skin, is apt to occur. If the disease tend to recovery, the symptoms gradually subside without any critical phenomena, and convalescence is protracted; if to a fatal termination, death is almost invariably preceded by coma. After death, the enveloping membranes of the brain and spinal cord are found in a morbid state, of which the most notable signs are engorgement of the bloodvessels, usually excessive, and an effusion of sero-purulent matter into the meshes of the pia mater, and beneath the arachnoid.[1]

SYNONYMS.—(a) *Technical*:—Cerebro-spinal fever (*Royal College of Physicians*); cerebro-spinal arachnitis; typhus syncopalis; tifo apoplettico tetanico; typhus cerebro-spinal (*Boudin*); cerebral typhus; epidemic meningitis (*Stillé*, U.S); petechial fever (*G. B. Wood*, U.S.); fever with cerebro-spinal meningitis (*S. Gordon*); malignant purpuric fever (*W. Stokes*); malignant purple fever; nervo-purpuric fever (*Mapother*): malignant purpuræ (*McSwinney*): pestilential purpuræ

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[1] Since the completion of this article the Royal College of Physicians, in its "Nomenclature of Disease," has adopted the following designation and definition of this malady: "*Cerebro-spinal Fever.* A malignant epidemic fever, attended by painful contraction of the muscles of the neck, and retraction of the head. In certain epidemics it is frequently accompanied by a profuse purpuric eruption, and occasionally by secondary effusions into certain joints. Lesions of the brain and spinal cord and their membranes are found on dissection."

(*Banks*); febris nigra (*R. D. Lyons*).—(b) *Popular*:—Spotted fever (*New England*); cold plague (*Southern States*, U.S.); Kolik, Nackenstarre, Genickkrampf (*Germany*); Nacksjuka, Dragsjuka (*Sweden*).

DESCRIPTION OF THE DISEASE.—1. *General Symptoms:*—Epidemic cerebro-spinal meningitis is observed in three principal forms: (A.—*Simple*), in which the symptoms indicative of disorder of the nervous centres predominate throughout the whole course of the disease; (B.—*Fulminant*), in which the depressed state of the vital powers, with profound blood change—as shown by hemorrhage of various forms into the cutis—characterize the disease; and (C.—*Purpuric*) in which the cerebro-spinal symptoms and the symptoms which mark blood-change (*petechiæ*, *purpuræ*, *vibices*, &c.), and flagging of the vital powers, occur together. The proportion in which the three forms of the disease are manifested varies considerably in different epidemics. In every outbreak cases are observed which link, by insensible gradations, one form with another; while in other, and rarer cases, the characteristic symptoms of the three forms are merged together. Continental and American writers have described an *abortive* form of the disease, the term being given (a) to certain anomalous symptoms observed in communities among which the disease is active: and (b) to sundry characteristic symptoms of the malady of transitory duration: such as severe cephalalgia: a sense of dragging at the back of the neck, or actual slight retraction of the head; cardialgia, enteralgia;—these symptoms often ending contemporaneously with the appearance of profuse perspiration, or epistaxis.

(A) *Simple Epidemic Cerebro-spinal Meningitis.*—In the majority of the cases before the onset of the disease the patient suffers from more or less indisposition. There are discomfort in the head, neuralgic pains in the back, the principal groups of muscles, and the abdomen; failure of the appetite, indifference to exertion, perhaps also slight shiverings, and a quasi-febrile state. These indications of disordered innervation may persist from three to seven days, or be manifested only during a few hours, before the confirmed malady fully declares itself. But in numerous cases the onset of the disease is sudden and characteristic. In both classes of cases the accession of the malady is declared by similar well-marked signs. Acute shivering is followed or accompanied by severe, commonly intolerable, headache or vertigo, or both; and after a short interval, or contemporaneously, profuse and irrepressible vomiting takes place, rarely preceded by nausea. Or vomiting may be the initiatory symptom, the shivering, headache, or vertigo following quickly after. The intensity of the symptoms marking the onset of the disease is remarkable and characteristic. The sickness is often, and from the outset accompanied by severe abdominal pain, apparently neuralgic; and not unfrequently this pain precedes the disorder of the stomach, as the cephalalgia precedes mental confusion. In like manner, the shivering ushers in, or is accompanied by, an acutely painful state of the muscles, more or less general, the forerunner of spasm. Cephalalgia and delirium, abdominal neuralgia and vomiting, and myalgia and spasm are the principal morbid factors of simple epidemic cerebro-spinal meningitis. They distinguish the malady, and the varying prominence with which they are met in different outbreaks gives rise to many diversities in the grouping of symptoms during the progress of the disease. The onward course of the disorder is usually rapid. The headache continues, often without a lull; vertigo occurs frequently; and after the lapse of a very brief period, measured usually by a few hours, the mind becomes confused, and, in some cases, a state of restlessness supervenes not unlike that observed in delirium tremens. The mental confusion assumes the form of muttering delirium, with periods of somnolence, often interrupted by cries provoked by the intense cephalalgia, or by the neuralgic pain elsewhere; or the patient falls into a state of apathy or stupor, from which he may be partially roused, but into which he relapses when left undisturbed, the mind acting as in a dream; or there is acute and violent delirium. Contemporaneously with, or immediately prior to, the mental disturbance, the painful state of the muscles increases, certain groups being more manifestly affected than others, especially the posterior muscles of the neck, the muscles of the spinal column, and those of the lower extremities. The pain often of an acutely neuralgic character, shoots along the spine and limbs, and across the walls of the abdomen. Partly as a voluntary action, partly as a consequence of spasm of the painful muscles, the head is drawn backwards. The retraction thus arising is one of the commonest and most characteristic symptoms of the disease. As the malady advances an actual or apparent tetanoid contraction of other groups of muscles may occur, the trunk most frequently being curved backwards, and the legs bent upon the thighs. At the same time there may be fleeting spasmodic actions of some of the muscles of the face, and occasionally of the eyeballs; or in some cases tonic contraction of these muscles, giving rise to the so-called sardonic laugh, or to persistent strabismus. In many cases cutaneous sensibility is much exaggerated, and very frequently a vesicular or roseolar eruption is developed, the former particularly about the lips. The aspect of the patient as the disease advances is dependent upon the degree of pain, the state of delirium or stupor, and extent of spasm which may be present. The countenance is rigid and contracted, the expression of face betokening acute pain; or it is dominated by the delirious fancies; or reflects the mental torpidity; or is distorted by spasm. There is frequently a slight effusion of the eyes, altogether different from the dusky appearance of typhus; and the face is commonly pale and sunken, seldom and only transitorily flushed and swollen, except when affected more or less extensively by the vesicular eruption. The surface sometimes moist, sometimes dry, rarely gives to the hand a sensation of febrile heat, although the temperature of the body ranges above the normal standard. The pulse from the outset is wanting in firmness, and the indications of defective tone increase as the disease advances. The respiration exhibits no marked disturbance, excepting an increase of rapidity witnessed during accessions of pain and restlessness, and in the advanced stage of the malady the diminution dependent upon failing circulation and innervation. The alimentary canal, apart from the vomiting, which usually ceases as the disease becomes fully developed, presents little indication of disturbance. The tongue is as frequently clean and moist as dry, foul, and discoloured; and the bowels may be either costive or loose, the former, perhaps, more commonly than the latter. In some outbreaks, indeed, costiveness has been marked and almost general, but in others diarrhœa has been prevalent. The renal secretion is rarely much disturbed.

As the malady proceeds, if it tends towards a fatal termination, the spasmodic symptoms increase, the patient becomes comatose, and death may occur either from asphyxia or exhaustion in from ten or twelve hours to seven or eight days. If the disease is prolonged beyond this period, various secondary lesions are apt to occur, especially certain inflammatory states of the eyes and ears, the mischief in the former organs being shown by ulceration of the cornea, iritis, and sometimes suppuration of the globe; in the latter by less obvious structural changes during life except as indicated by deafness. Or there may be paralysis affecting one half of the body, or one side of the face, or one of the limbs, or an isolated group of muscles. Or there may be an inflammatory state, with sero-purulent effusion into one or more of the large joints. Or, finally, the patient may fall into a state of marasmus and nervous exhaustion, often protracted and not rarely fatal. If the malady proceed to a favourable termination without any of these sequences, health may be recovered in from three to four weeks. If the progress of the disorder, otherwise favourable, is interrupted by one or other complication, the period of recovery is uncertain and often long postponed.

(B) *Fulminant Epidemic Cerebro-spinal Meningitis.*—In the siderant form of the malady the onset is without premonition. The patient suddenly falls into a state of collapse. The surface of the body has often a cyanotic aspect, and is cold and clammy to the touch, or covered with a profuse perspiration, the face being not rarely shrunk and livid, and the eyes deep sunk as in the algide stage of cholera. There may be some shivering at intervals, more or less pain of the head, and occasional vomiting, sometimes of a grumous black or coffee-coloured fluid. Drowsiness, if not present at the outset, rapidly supervenes, followed by or concurrently with delirium. Coma, rarely other than the precursor of death, quickly succeeds. In the mean time, purpuric spots show themselves over the surface of the body generally, red or purple and circumscribed in the beginning, but rapidly becoming black, and often extending their margins so as to form irregular inky blotches, or streaks, or great patches; and not unfrequently several of the spots become gangrenous. Sometimes the purpuric spots appear contemporaneously with the collapse at the outset of the attack. The respiration is preternaturally slow, and the pulse (if it has not been absent at the wrist from the beginning) falls with the progress of the disease. The urine is loaded with albumen. Life may be extinguished in less than *five hours*, or it may be prolonged for two or three days. Recovery from this form of epidemic cerebro-spinal meningitis is not unknown, but it is an exceedingly rare event.

(C) *Purpuric Epidemic Cerebro-spinal Meningitis.*—In the purpuric form of epidemic cerebro-spinal meningitis, the symptoms which distinguish the simple and fulminant forms of the disease occur combined together in various proportions, some cases approximating more or less closely to the latter, others, as is most common, to the former variety of the affection. Thus concurrently with shivering, intense headache, vomiting, rachialgia and retraction of the head, there may be depression of the vital powers approaching collapse, or collapse itself, with the development of petechiæ, purpuræ, vibices, ecchymoses, hemorrhage, from the mucous tracts, delirium, coma, and rapid dissolution. In by far the greater number of cases, however, the disease follows the course of simple epidemic cerebro-spinal meningitis; but within twenty-four hours, or from this period to the fourth day, or still later in the progress of the malady, petechiæ or purpuræ are developed more or less copiously, and occasionally hemorrhage occurs from the mucous tracts. This phase of epidemic cerebro-spinal meningitis does not appear to be more fatal than the simple form of the disease. It has been observed more commonly in the United States than on the continent of Europe, and it was the principal variety which occurred during the recent outbreak in Ireland.

SPECIAL SYMPTOMS.—1. *The Nervous System.*—Headache is almost constant, and it is remarkable for its early and persistent severity. At the outset it is not localized in any particular part of the head. It may be referred to the forehead, the sides, the vertex, or the occiput; or it may be general. Later in the disease, the occiput is, perhaps, most commonly the seat of pain. The intensity of the headache is, as a rule, peculiar. The patients describe the pain as sharp, lancinating, stabbing, plunging, tensive, throbbing, boring, or crushing. It is so intolerable as to elicit groans and cries from the sufferer; often even during delirium or stupor, the exclamations, the contraction of the forehead, and the manner in which the hands are moved towards the head, show that the pain continues. In young children this state closely resembles that which is so significant of tubercular meningitis. The headache may cease when the disease has become fully developed, or, as is probably more common, it may persist throughout the whole course of the malady so long as consciousness remains. Occasionally, indeed, when recovery takes place, it will continue far into the period of convalescence.

Rachialgia is rarely absent. It is sometimes general throughout the spinal region, but more frequently it is limited to the loins, the dorsal region, or, as is most usual, to the posterior part of the neck. Occasionally the pain radiates from the neck to the extremities and walls of the abdominal and thoracic cavities. In rare cases the pain has commenced at some point of the peripheral nervous system, and spread thence to the back, occurring in paroxysms. This pain has the same character as the cephalalgia, and the words (intolerable, atrocious, tensive, &c.) used to indicate the nature of the latter may be employed also to describe the former. It is augmented by movements, and its chief seat is in the muscles of the spinal column.

The nuchal pain and its consequences constitute one of the most characteristic signs of the disease. Frequently at the outset of the malady, this pain is preceded by a dragging sensation at the back of the head. As the pain increases in intensity, the head is voluntarily thrown back to relieve all strain upon the exquisitely sensitive muscles. Or, in conjunction with the pain, spasm of the affected muscles occurs, and the head is forcibly drawn backwards. Among the popular terms of the disease, those arising from this symptom (Nackenstarre, Genickkrampf, Nacksjuka, &c.) are very prominent. When the rachialgia is more diffused, and the pain extends also to the limbs, adapted or spasmodic contractions of the trunk and lower extremities are apt to occur. Rachialgia is not present in the siderant and in severe cases of the purpuric forms of the affection. It is noteworthy that pressure on the spinous processes, during the most acute rachialgia, rarely causes pain.

Enteralgia and other Neuralgic Pains.—Abdominal pain, neurálgic in character, and more or less closely linked to the pain in the course of the spine, is not unfrequent, and it is often closely associated with uncontrollable vomiting. In some epidemics, as in that of 1865 on the Lower Vistula, enteralgia was so common among children seized with cerebro-spinal meningitis that it gave rise to the trivial designation "belly-ache," as one of the popular names of the disease. Neuralgic pains in the limbs, referred to in connection with rachialgia, are less common than like pains along the course of the spine and in the abdomen.

Increased Sensitiveness of the Surface of the Body has been described as frequent in several outbreaks. During the recent epidemic in the United States, cutaneous hyperæsthesia is said to have been a characteristic symptom of the disease in its fully developed state. During the outbreak on the Lower Vistula, an increase of cutaneous sensitiveness was also observed very commonly, but it was not regarded by Dr. Burdon Sanderson as a characteristic symptom, but "a mere consequence or interlude of pain:" being, in fact, an excessive tenderness experienced during intermissions, or after the cessation of pain.

Spasm.—Sufficient care has not always been taken to discriminate between apparent and actual spasm in this disease. Tourdes, in 1843, showed that the retraction of the head and curvature of the spine did not in all cases arise from a spasmodic contraction of the muscles, but that the position was not rarely voluntarily or instinctively assumed by the patient as most conducive to relief of the spinal pain. Dr. Burdon Sanderson confirmed this observation of Tourdes, so far as retraction of the head was concerned, in 1865. In the cases observed by him, in which the head was apparently drawn backwards, it was practicable to extend the seemingly contracted muscles, although the effort gave rise to exquisite pain and instinctive resistance. There was not any tension of the muscles except such as arose from this resistance; no tightness was felt so long as they were at rest. "It was not till the neck was completely extended that the muscles became hard, and even then the hardness was not for a moment comparable to that which is felt in tetanus." The position in bed of the patients observed by Burdon Sanderson was that which would produce the greatest relaxation of painful groups of muscles. There can be no doubt, however, that spasm is a frequent accompaniment of epidemic cerebro-spinal meningitis. In the clonic form it is witnessed in some cases as transitory contractions of the facial muscles, cramps of the extremities, the convulsive agitation and trembling referred to in the general description as somewhat like what is observed in delirium tremens, very rarely in local convulsion of a single limb, and still more rarely in general convulsion. Tonic spasm of the muscles of the face, jaws (trismus), and gullet, and of the limbs and trunk, may also occur, giving rise to true opisthotonos, emprosthotonos, or general tetanic rigidity of the trunk and limbs.

Paralysis is not of very common occurrence during the progress of epidemic cerebro-spinal meningitis. Hemiplegia has been occasionally noticed, and paralysis more or less complete of one or both extremities, upper and lower, of the muscles of deglutition, of articulation, and of certain other associated groups, the latter chiefly towards the close of the malady. The general paralysis noticed by some writers was usually significant, and, indeed, a part of the phenomena of approaching dissolution.

The *special senses* do not often manifest much change, except as a consequence of certain structural lesions. Increased, sometimes exquisite, sensitiveness of sight and hearing has occasionally been noticed, concurrently with augmented sensitiveness to other external impressions, especially towards the close of the malady, when complete consciousness returns. Amaurosis has also occurred, without apparent change in the ocular apparatus. It may be noted, moreover, of the eye and sight, that occasionally there is strabismus and double-vision. The pupils may be normal in aspect and action, or they may present various changes. They may be dilated or contracted, or one dilated and the other contracted, or they may exhibit curious alternations of contraction and dilatation under the influence of the same degree of light. Both the *eyes* and the *ears* are liable to undergo certain structural lesions. These consist in well-marked inflammatory changes, commencing sometimes in the cornea, sometimes in the deeper tissues. Most commonly keratitis is set up, ending in opacity or ulceration; and if the latter, the iris may become involved. Or, iritis may occur independently, with effusion of lymph or pus, and the consequences thereof (synechia posterior and distortion of the iris are particularly noted). Of more deeply-seated changes may be mentioned opacity of the lens or of the vitreous humour, separation of the retina from the choroid, purulent infiltration, or atrophy of the eyeball. The ear suffers, perhaps, more frequently than the eye. Deafness is probably more common than defects of vision, and it is largely dependent upon inflammatory changes set up in the organ, and particularly affecting the lining membrane of the vestibule and semicircular canals. Occasionally, the external meatus has been affected, and a profuse purulent discharge flowed from it. These lesions of the organs of sight and hearing may occur either early or late in the course of the disease. The sense of *smell* very rarely suffers. Its loss in one nostril has been recorded in a single case, and this, perhaps, dependent upon inflammatory changes in the lining membrane of the nose, as purulent discharge from the nostrils has occasionally taken place.

Vertigo is sometimes observed as an initial symptom of the disease in conjunction with the cephalalgia. Instances are recorded in which the first accession of the disease was marked by severe giddiness, during which the patient either staggered about like a drunken man, or turned round several times, and then fell.

Delirium is rarely absent. It varies much in character, and may occur at any period of the seizure. It may be quiet or violent, transitory or more or less persistent. It sometimes, but rarely, forms one of the symptoms of invasion, when its access is sudden and its character acute. It may supervene with violence after the malady has continued several hours or two or three days. In the acute form of delirium, the patient is very noisy, and often so violent as to require restraint. Sometimes it happens that paroxysms of furious excitement occur with intervals of placid delirium. Hence the necessity of great watchfulness in the care of these cases. Most commonly the delirium follows closely upon the initiatory symptoms, and is aggravated as the disease advances. At the beginning, the confusion of thought may not be so great but that the patient can be roused so as to answer questions intelligibly. Later, the incoherence becomes much greater, and is usually accompanied with considerable agitation. Much difference is observed, not only in the degree of impairment of the consciousness, but also in the periods of manifestation of the impairment. In some cases, the delirium occurs chiefly during the night; in others, and very commonly, it alternates with periods of somnolence or of quietude. In the more persistent cases there are usually exacerbations. If the disease tend to a fatal ending, the delirium is followed by coma; if to recovery, consciousness is, as a rule, gradually recovered: but, at times, a period of stupor intervenes between the subsidence of the delirium and returning perception. In the slightest cases of the malady the delirium may be transient only, taking place at intervals chiefly during the night. In the gravest cases, when death occurs in a few hours, delirium is most commonly present. The duration of the delirium depends entirely upon the nature and duration of the case. Instances are recorded in which furious delirium has occurred for three nights in succession. In other instances a delirious state has persisted more or less continuously for fifteen days.

Stupor and Coma.—In not a few protracted cases, delirium is followed by a prolonged state of stupor, the patient lying completely indifferent to external impressions. In six cases observed by Dr. Burdon Sanderson, in which there had been violent delirium at the outset, this state lasted from one week to five weeks, the mean duration of the several cases being nineteen days. The observer remarks, however, that as four of the cases "emerged from their stupor in a state of complete deafness, there was much difficulty in limiting accurately the period of unconsciousness." Sometimes the state of stupor supervenes without the intervention of violent delirium. *Coma* occurs in nearly all fatal cases, and is, indeed, generally the forerunner of death.

2. *The Digestive System.*—The uncontrollable *vomiting*, which is one of the characteristic initiatory symptoms of the disorder, is an effect of the cerebral mischief. Most frequent at the beginning of the malady, the vomiting diminishes as the disease advances, occasionally increasing, during exacerbations. The matter evacuated, after the stomach has been emptied of food, is usually of a greenish or yellowish colour and bitter taste, and is composed largely of bile; more rarely it is viscid and white. Occasionally, in the fulminant and purpuric forms of the malady, a grumous black or coffee coloured fluid is vomited. In several outbreaks, the vomiting of large quantities of *Ascarides lumbricoides* has been specially noted. The *buccal cavity* and *tongue* do not exhibit any particular signs, except in those rare cases in which there is hemorrhage from the gums. As a rule, the tongue is clean and natural at the outset, and its subsequent state depends upon the degree of febrile excitement which may be set up, or the development of a typhous state, when it may become foul with various well-known aspects, or dry and black sordes accumulating on the teeth. From the beginning of the attack the appetite for food is destroyed, whatever the state of the buccal cavity; and sometimes there is much, at others insatiable thirst. The *bowels* are more commonly costive than the reverse. In some outbreaks costiveness has been of general occurrence. Diarrhœa, late in the disease, is not unfrequently to be attributed to the previous administration of purgatives, and involuntary stools are usually one of the accompaniments of complete nervous and vital prostration.

3. *The Urinary System.*—In the simple form of epidemic cerebro-spinal meningitis the urine does not exhibit any marked change. It may be more abundant, and slight deposits of lithic acid may occur. In the fulminant, and severe cases of the purpuric forms, it commonly (in the first-named form perhaps invariably) contains albumen, sometimes in large amount, and occasionally cylindrical casts and blood-corpuscles. Retention or incontinence of urine has occurred in the progress of the disease.

4. *The Respiratory System.*—In all the graver cases the respiration is more or less altered. It is sighing, laboured, or interrupted. Dr. Burdon Sanderson writes of the outbreak on the Lower Vistula: "In all severe cases, whether of children or adults, the breathing was embarrassed in proportion to the general gravity of the symptoms. This embarrassment was marked by a slow, laboured inspiration, followed by quick respiration and a long pause, that condition of breathing which is so frequently observed in continued fever (especially typhoid), and is often called suspirious. In all the fatal cases which came under my notice, the most prominent symptoms which preceded death were those which indicate impairment and perversion of the respiratory function. As the breathing became more hurried and difficult, the general depression became more intense, the pulse became weaker and quicker, and the temperature of the skin more elevated." Dr. S. Gordon records a case, fatal in less than five hours, in which the respirations rapidly fell to nine per minute, the pulse at the time being 120.

5. *The Circulatory System.*—The cardinal point with respect to the circulation, as indicated by the radial *pulse*, is defect of arterial tension. This has been common to all epidemics, with hardly an exception; and the exceptional instances have probably been more apparent than real. The frequency of the pulse does not admit of general statement. It has a wide range. In the epidemic on the Lower Vistula, the pulse in six adult cases observed by Dr. Burdon Sanderson varied from 56 to 98, the average beats being 85. In several cases noted by the same observer "its frequency varied considerably from day to day, without apparent relation to the condition of the patient in other respects." During the Philadelphia outbreak of 1866, in 98 cases observed by Dr. W. H. H. Githens, the pulse varied from the normal beat to 150 per minute in uncomplicated cases, and reached as high as 160 in two cases, in puerperal women. "It was in all very weak, with a dichrotic tendency, sometimes entirely imperceptible in the radial artery, and always interrupted by slight pressure."

6. *The Cutaneous System.*—In respect of dryness or moisture or feeling to the touch, the *skin* presents no constant condition; but in numerous cases it is the seat of various forms of eruption of remarkable interest. The extent of prevalence or predominance of one or other of these different forms of eruption has varied considerably in the numerous recorded outbreaks. In the epidemics which have occurred in the United States, *petechiæ* have been so common as to have given rise to the popular name of the disease (*spotted fever*), and to have induced Dr. G. B. Wood, Professor of the Theory and Practice of Medicine in the University of Pennsylvania, to adopt as the technical designation of the disease the term *petechial fever*. During the recent outbreak in Ireland (1866–67), *purpura* was the predominant form of eruption, and Professor Stokes proposed to designate the malady *malignant purpuric fever;* other observers also suggesting terms founded upon this character. In the outbreak on the Lower Vistula (1865), an herpetic eruption was most common. In all the greater outbreaks, each form of eruption mentioned in the definition of the disease has been observed; but the proportion of cases in which one or other form of eruption has prevailed has varied greatly in each outbreak. In some of the earlier outbreaks in the United States few cases occurred in which a petechial eruption was not noted. Of 98 cases admitted into the Philadelphia Hospital (Blockley) in 1866, 36 had petechiæ; 13 mixed petechiæ and erythema; 9 erythema and urticaria; 3 indistinct petechial mottling, and 37 no eruption at all (GITHENS). In the outbreak on the Lower Vistula the proportion of cases exhibiting an eruption was comparatively small; in the recent outbreak in Ireland, large. The forms of eruption observed are as follows: (*a*) *Vesicles.* A vesicular eruption (*eczema*, HIRSCH), sometimes herpetic in character, chiefly appearing in the vicinity of the lips, but occasionally extending over the sides of the face, diffused more or less on the trunk, or showing itself in patches on the limbs. This symptom has occasionally taken the form of shingles. It is most commonly noticed in the simple form of the disease, but it may take place in either of the other forms, and when associated with purpura,

the vesicles may be flattened and rest upon a livid base, presenting a horrible aspect. This form of eruption may appear as early as the second day. (*b*) *Purpura*. 1. True *petechiæ*. 2. *Purpuric spots*, varying in size from a split pea to half-a-crown, with more or less extensive effusions of blood, or of its colouring matter, into the cutis (*vibices*, *ecchymoses*). The spots have sometimes a regular, sometimes an irregular, even a ragged, outline. Their size may remain fixed from the time of their first appearance, or it may increase largely and rapidly. They may be of a light or dark red colour at the outset, subsequently becoming purple and black; or, as is most common, they may from the beginning be dark purple or black, their blackness being often fittingly likened to that of ink—the eruption resembling "spots" or "splashes" of that fluid. They may appear on the trunk or limbs only, or they may be scattered copiously over the whole surface of the body, including the face. The purpuric spots are frequently hard to the touch, the margin being defined, and giving the impression to the fingers of being raised above the surface: sometimes a vesicle forms above several of the spots, and gangrene of the adjacent tissue takes place. Dr. S. Gordon writes of the recent epidemic in Ireland: "Many cases are accompanied by a distinct eruption, which comes out with great rapidity; is found over all parts of the body, but chiefly on the lower extremities; is of a very dark colour, sometimes very deep brown, or purple, or even black. The spots are of various sizes and shapes, some small and round, others large and irregular; some appear like large spots of very black purpura, only more mottled and more irregular in colour and shape; others are more confined, and raised above the level of the skin, consisting in effusion into its substance: many patients die in this stage, but in some the disease progresses, and these spots are absorbed, leaving a yellowish mark under the cuticle; or they pass into superficial gangrene, which was spreading at the time of the patient's death, or is healed with loss of substance." Purpuric spots are sometimes, although rarely, one of the earliest signs of the fulminant and purpuric forms of the malady; or they may occur at any period during the more advanced stages. Usually they appear at some period during the first four days, chiefly perhaps during the first or second day. Sometimes, with or without the purpuric spots, there is a cyanosed aspect of the skin, or a peculiar livid mottling. During recovery the pupuric spots gradually lose their definition and fade away, passing through the different stages of colour which mark a healing bruise. (*c*) *Roseola, erythema, &c.* Rose-coloured spots or patches are occasionally observed; also erythema, more or less diffused, a rubeoloid eruption, and urticaria.

7. *Temperature.*—The temperature of the body, as marked in the axilla, is heightened in every case; except, perhaps, those accompanied by profound collapse from the beginning. In many cases this heightened temperature is found contemporaneously with the invasion of the disease; in other cases there is no conspicuous increment until the second or third day. When the characteristic symptoms of the malady are developed, the temperature rarely falls below 100° Fahr., and, as the disease advances, it ranges in adults from 100° to 105°, in

children sometimes even higher. There is no constant or conspicuous difference between the morning and evening temperature, as in typhus and typhoid. A steady fall marks the decline of the disease and the approach of recovery; a rapid fall ushers in collapse or death.

COMPLICATIONS.—The course of the disease is liable to be modified by certain complications. Of these the chief are as follows: (*a*) Thoracic inflammations: pleurisy, pneumonia, bronchitis, or pericarditis. Dr. S. Gordon describes œdema of the lungs and diffuse pulmonary apoplexy. (*b*) Swelling or inflammation of the parotids. (*c*) Inflammation of the large joints, marked by swelling and pain, and sometimes ending in sero-purulent effusion. This complication, in its less aggravated form, has been described by some writers as rheumatic. (*d*) An Inflammatory condition of the eyes and ears, as already noted. (*e*) Bed-sores. Large, deep, black sloughs occurred in four cases out of 161 treated in the Philadelphia Hospital in 1866. (*f*) The course of the disease has also been complicated by the supervention of other maladies, namely, (1) *Intermittent fever*, or certain paroxysmal phenomena simulating malarious poisoning: a complication which has led to erroneous notions of the nature of the disease. In the outbreak on the Lower Vistula cases were observed in which regular or irregular intermissions took place that could not be assigned to a malarious origin. (2) *Typhoid fever*, the two diseases prevailing simultaneously in the same district. The symptoms of both diseases, more or less modified, pursue their course together, and the characteristic lesions of typhoid as well as of epidemic cerebro-spinal meningitis are discovered after death. (3) Measles and scarlet fever. (4) Cholera (LEVY).

DURATION.—In the outbreak on the Lower Vistula, the most acute cases terminated fatally in from 12 to 72 hours. Cases of less intensity, but in which the patient eventually died in a typhous state, lived from 8 to 14 days, the characteristic symptoms of the disease persisting to the end. In the more protracted, or complicated cases, from 5 to 8 weeks have passed before a patient entered upon convalescence, and death has taken place in the 6th or 7th week. Of the cases observed in the Philadelphia Hospital (1866). the duration of those which ended fatally was from 48 hours to 11 days; of those which recovered, from 20 to 30 days, the acute symptoms rarely exceeding a fortnight. In the recent outbreak in Ireland, Dr. S. Gordon has reported a well-marked case which ended fatally after less than *five hours'* duration. A large proportion of the fatal cases in that outbreak died in from 10 to 48 hours; in other cases the fatal ending did not occur until the end of the second and during the course of the third week of the disease. The duration of the disease, as shown by death, may be clearly stated; as marked by the beginning of convalescence, it does not admit of definite description. Moreover, convalescence is often very protracted. The course of the disease towards recovery is sometimes interrupted by *relapses*.

TERMINATION.—The disease terminates after a longer or shorter period of convalescence in health; or it entails during convalescence a series of physical or mental ills; or it ends in death. The rate of *mortality* of the disease is the measure of probable recovery. It varies much in different outbreaks, but is at all times formidable. Among the cases observed in the Philadelphia Hospital in 1866 the mortality was 33 per cent.; in the Hardwicke Hospital, Dublin, the same year, the mortality was 80 per cent. Dr Stillé remarks that, "while ten epidemics in various places, occurring between 1838 and 1848, presented an average mortality of 70 per cent., a similar number occurring during the decade from 1855 to 1865 give an average mortality of about 30 per cent. This remarkable fact would seem to indicate a gradual decline of power in the epidemic." The minimum rate of mortality recorded is 20 per cent. The proportion of fatal cases is greatest, and the duration of these cases least, at the commencement of an outbreak. The *sequelæ* which interfere with the restoration of the patient to perfect health are: Deafness; impaired vision from structural changes in one or both eyes; paralysis of one or more limbs or of certain groups of muscles; impaired memory; carbuncles, and boils. Dr. S. Gordon describes a case in which the patient "recovered from all the acute symptoms, but gradually passed into a state of almost organic life. He ate, drank, and slept well; he passed solid feces and urine without giving any notice, yet, evidently, not unconsciously; he was excessively emaciated, and there was a peculiar mouse-like smell from him; he seemed to understand what was said to him, but he could not answer; he never called for anything; his breathing was rather slow; his pulse 120; his heart acting with a peculiar strong jerking motion; his eye was quite well, as also his knee [he had suffered from ulceration of the right cornea and immense effusion into the right knee-joint]; he could draw his legs and arms up to him; but he could not use his hands at all." Such was the condition of the patient fifty-eight days after the invasion of the disease.

MODE OF DEATH.—Death chiefly occurs from (*a*) asphyxia, caused by damage to the respiratory nerve centres; (*b*) from asthenia; and (*c*) in some of the fulminant cases probably from necræmia, so profound are the changes observed in the blood.

DIAGNOSIS.—In some instances the disease approximates in certain symptoms to *typhus* or *typhoid*, and it occasionally prevails contemporaneously with both maladies. But the history of the development and progress of the disease, with the absence of characteristic eruption, will usually clear up any doubt. From *sporadic spinal meningitis* the disease is distinguished by its epidemicity, the almost constant concurrence of cerebral disorder, the tendency to cutaneous eruptions, the great mortality, and the rareness of protracted or permanent paralysis or contraction of the lower limbs. The distinction between the disease and *cerebral meningitis* is less defined as to particular symptoms, especially in children, but the mode of development of the malady will rarely leave much room for doubt during an outbreak. *Tetanus* (so called idiopathic), with which it is suggested that epidemic cerebro-spinal meningitis may, under certain states of spasm, be confounded, never manifests the early grave cerebral symptoms which occur in the latter disease. The tetanoid contraction also observed in epidemic cerebro-spinal meningitis is rarely, if ever, as in tetanus, aggravated by sudden and painful spasms. The grouping of the symptoms in the two diseases is, moreover, altogether different. Dr. S. Gordon points out the possibility of confounding the purpuric form of epidemic cerebro-spinal meningitis with malignant measles, which malady has often prevailed at the same time. The last-named disease may resemble the fulminant form of the first-named in several respects particularly the rapidity of development, and dark colour of the eruption, and the rapid appearance of petechiæ; also in the sudden and often extreme collapse which accompanies the invasion of the affection. But the eruption of measles rarely loses its characteristic form, and the affection of the respiratory passages is commonly present, while purpuric spots and patches are seldom observed. Dr. S. Gordon also states that he has known several cases in which the earlier symptoms of epidemic cerebro-spinal meningitis in young excitable females have been mistaken for *hysteria.*

PROGNOSIS.—At the best, the prognosis of the disease is very grave. The mortality may be equally great in each of the three varieties, and petechiæ and purpura do not necessarily indicate an aggravated degree of danger as in other acute diseases. In 50 per cent. of the cases recorded by Dr. Githens, in one of the least fatal outbreaks known, petechiæ were present, and it is especially remarked that neither this nor any other form of eruption had "any reference to the prognosis." But when hemorrhage into the cutis is extensive, either from the number or the size of the spots, and is accompanied by marked signs of vital prostration, it indicates an extremity of danger, although not a certainty of death. The disease is more fatal among infants and young children than among youths and adults in the prime of life; but, in some outbreaks, the latter have suffered most. After thirty years of age it becomes more dangerous. Life is most endangered in the earlier days of the disease, particularly during the first five. But danger is present at all periods of the malady, and the convalescent is not entirely safe until health is fully restored. Of the special symptoms, whether of excitement or depression, the rules of prognosis hold good which apply to other highly fatal acute maladies.

MORBID ANATOMY.—The essential anatomical characteristics of the disease, found after death, are hyperæmia, often intense, of the pia mater of the brain, and spinal cord; with more or less copious subarachnoid, and interstitial effusion into the meshes of the congested pia mater, either of serum, or of a transparent, gelatinous material, or of purulent matter: the latter more frequently than either of the two former. The purulent effusion is of greenish or yellowish colour, and is sometimes flaky. It has been found in a case in which death took place in less than five hours from the invasion of the disease (S. GORDON). The extent to which these appearances are observed and the amount of effusion varies greatly in different cases. No part of the encephalic or spinal pia mater and arachnoid may be free, or certain portions alone may be affected; but effusion is limited to the subarachnoid space, and does not occur into the arachnoid cavity. Under the microscope, according to Dr. Burdon Sanderson, the gelatinous material is "always found to consist of cell-like bodies, either adhering to each other so closely that they could not be completely separated, or imbedded in a transparent interstitial substance, while the sero-purulent liquid which occupied the spinal sub-arachnoid space, and in some cases the ventricles, exhibited corpuscles and granules floating freely. The cell-like bodies, although in general resembling pus corpuscles, did not present that uniformity of size and character which is met with in normal pus. They were usually, but not always, of regular circular contour, and varied in diameter from $\frac{1}{3500}$th to $\frac{1}{1200}$th of an inch. Occasionally they exhibited the appearance of an external cell-membrane, but in most instances this could not be made out even in perfectly fresh exudations—as, *e. g.*, in those cases which were examined as early as eight hours after death. They invariably contained numerous granules, some of which were cleared away on the addition of acetic acid. Those which remained were highly refractive, but did not assume any special form of arrangement. The interstitial substance was beset with granules, some of which were albuminous, others fatty. It was most abundant and distinct on the surface of the spinal arachnoid, where it infiltrated the fine connecting tissue and minute bloodvessels of the pia mater."

For the rest, the nervous system of the brain and spinal cord is usually gorged with blood, except death has taken place late in the course of the disease. The visceral arachnoid is frequently thickened and opaque. Softening of some portion of the spinal cord has sometimes been observed; and Mr. J. Simon thinks that, "for practical purposes, the state of the covering membranes of the nervous centres may be regarded as a mere index of changes more or less distinctive, which those centres in their own intimate composition have at the same time undergone; and hence it is that the essential phenomena of the disease during life consist in disturbances, more or less grave, of the functions of these all-important organs."

In fatal cases of the simple and purpuric forms of epidemic cerebro-spinal meningitis the characteristic anatomical lesions are almost invariably found. In the fulminant form of the disease they are often absent. The cases in which there is no indication of morbid change in the nervous centres are exceedingly few. It has been suggested that in these cases death has occurred so rapidly that there was insufficient time for the formation of a structural lesion. In connection with this explanation the case recorded by Dr. S. Gordon must be borne in mind, in which purulent effusion was found, although the whole duration of the attack was under *five* hours. Practically the apparent absence of characteristic anatomical change in the nervous centres in certain rare cases of epidemic cerebro-spinal meningitis is a phenomenon analogous to that which sometimes occurs in rapidly fatal cases of malarious, variolous, and scarlatinous poisoning, in which the characteristic eruptions or lesions of the diseases have not been developed.

No lesions peculiar to epidemic cerebro-spinal meningitis are found in other organs of the body. Such lesions as occur elsewhere than in the coverings of the brain and spinal cord usually have a definite relation to the thoracic, abdominal, or genito-urinary complications which may have happened during the progress of the malady. In the fatal cases of the purpuric form of the affection recorded by Dr. S. Gordon, and other writers, an excessive fluidity of the blood was noted.

HISTORY AND GEOGRAPHICAL DISTRIBUTION.—The history of epidemic cerebro-spinal meningitis dates only from the fourth decennium of the present century. At that period the disease was for the first time, clearly distinguished as an independent malady; and with the light then obtained, outbreaks which had occurred earlier in the century, in various localities of both the Eastern and Western hemispheres, and had been recorded under other names, were recognized as of similar character. It has been sought, indeed, to show that epidemic cerebro-spinal meningitis has probably existed from remote periods (TOURDES, BOUDIN). The probability may be admitted, for the first recognition of a malady as an independent affection does not necessarily imply that the malady is new.

In 1837 epidemic cerebro-spinal meningitis broke out in the southwest of France, and prevailed in various localities of the district intervening between Bayonne and La Rochelle, and along the whole line of the Pyrenean frontier. Dax, Bordeaux, Auch, Foix, Narbonne, and Perpignan suffered, as well as the two cities previously named. The disease, according to Boudin, at the commencement and during the continuance of this outbreak, chiefly showed itself among troops in garrison. During 1837 and 1838 the garrisons of Bayonne, Dax, Bordeaux, Rochefort, and La Rochelle suffered. From 1838 to 1841 the disease was prevalent among the garrisons of southeastern France, particularly those of the valley of the Rhone. Thus it broke out at Toulon, Marseilles, Aigues-Mortes, Nismes, Avignon, and Pont-Saint-Esprit. In the course of the four years, 1839–40–41–42, the malady appeared in succession among the troops occupying the fortresses of Strasburg, Schelestadt, Colmar, Nancy, Metz, and Givet. From 1839 to 1842 it prevailed among the forces at Versailles, Saint-Cloud, Rambouillet, and Chartres. Those stationed along the coast of Brittany, at Brest, L'Orient, Nantes, and Ancenis, suffered in 1841; and during 1840 and 1841 the disease manifested itself among divers detachments of a regiment scattered at Laval, Le Mans, Château-Gontier, Tours, and Poitiers. It was during the outbreak of which the most remarkable episode is thus sketched by Boudin that a scientific knowledge of epidemic cerebro-spinal meningitis was first obtained. From 1837 to 1848 inclusive, forty-seven outbreaks of the malady were recorded in thirty-six of the eighty-six departments into which France was then divided. These outbreaks were distributed in the departments of the Loire, Rhone, Bouches-du-Rhone, Bas-Rhin, Seine, Seine-et-Oise, Landes, Basses-Pyrénées, Charente-Inférieure, Gard, Vaucluse, Var, Moselle, and Loiret. The three first-named departments suffered most. In 1840, the disease appeared in Naples and prevailed in the Papal

States. The same year it broke out among the French garrison at Douera, Algeria, and during the next seven years it attacked numerous towns and localities of the province, affecting the civil population, both European and native, as well as the military. In 1844 an outbreak of the disease took place among the civil population of Gibraltar; and in 1846 the malady showed itself slightly in Ireland among the inmates of the Rathdown, South Dublin, and Belfast workhouses, and several cases occurred among the population of Dublin. During 1849 and 1850 the disease was prevalent to some extent among the French troops in Italy, and in the last-named years several localities of France suffered from it. Epidemic cerebro-spinal meningitis appeared in Denmark in 1841, and prevailed in that country until 1848. The disease was first noticed in Sweden in 1854, this country again suffering from it in 1861. In Norway the malady broke out in 1859, and it has prevailed in that country more or less since that year. During 1860 the disease was prevalent in Holland; and the same year it was widely spread in Portugal. In 1863, 1864, and 1865 an extensive outbreak occurred in North Germany; and in 1866 the malady broke out in Dublin and elsewhere in Ireland.

In the United States (where the disease may be traced back to the commencement of the century), epidemic cerebro-spinal meningitis became prevalent about the same time that it exhibited great activity in Europe. From 1842 to 1850 inclusive, a series of outbreaks took place in the States of Kentucky, Tennessee, South Illinois, Mississippi, Arkansas, Alabama, Pennsylvania, Massachusetts, New York, and North Carolina. After this period there would appear to have been an interval of comparative inactivity. In 1861 the disease broke out in North and Central Missouri, and from that time to the present it has prevailed, more or less extensively, in almost all, if not all, the States of the Union, with the exception, perhaps, of the Pacific States. In 1862 outbreaks were recorded in Connecticut, Kentucky, Indiana, and Tennessee; in 1863, in Rhode Island; in 1864, in Pennsylvania, Ohio, Illinois, New York, Maryland, Massachusetts, and Vermont; and in 1865 in North Carolina and other Southern States. During the past year the disease was active in several States.

It must be borne in mind that these historical notes very imperfectly represent the probable prevalence and geographical distribution of the disease. They simply include a brief summary of outbreaks which have come under the notice of thoughtful observers who have published their observations. The history of the malady in the British Islands is, perhaps, less liable to error from this source. The earliest recorded outbreak of the disease occurred in Ireland during the early months of 1846. It broke out to a very limited extent among the boys living in the Rathdown Union, South Dublin, and Belfast workhouses; and two cases, both females, one aged 17 years, the other 36 years, were admitted into the Hardwicke Hospital Dublin.[1] Prior to this outbreak, there is not any trustworthy history of the presence of epidemic cerebro-spinal meningitis in the British Islands.

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[1] Dr. Robt. Mayne, Dublin Quarterly Journal of Medical Science, 1846, vol. ii. p. 95.

It is not improbable, however, that the disease existed at Blackaton, in Devonshire, in 1807;[1] and at Sunderland in 1830.[2] Dr. B. W. Richardson saw an unquestionable case at Mortlake, Surrey, in 1843.[3] From the time of the outbreak in 1846, cases of a similar malady were occasionally observed in Dublin, until the latter half of 1850, when they became more common.[4] There is no further notice of epidemic cerebro spinal meningitis in Ireland until the year 1865, when cases began to be again observed in Dublin.[5] A case of cerebro-spinal meningitis was observed by Dr. Samuel Wilks, in each of the three years 1856, 1858, 1859, in the metropolis.[6] In October, 1859, a fatal case of cerebro-spinal disorder, with petechial eruption, came under the notice of Dr. Henry Day, in the vicinity of Stafford. In this case, hyperæmia of the meninges of the brain and spinal cord, and copious effusion of fluid at the base of the brain, were discovered after death. A similar but more rapidly fatal case was also observed by Dr. Day, in the Stafford General Infirmary in September, 1865.[7] The largest and most fatal outbreak of epidemic cerebro-spinal meningitis which has occurred within the limits of the United Kingdom began in Ireland in March, 1866, and attained its chief development in the subsequent winter. Its effects were almost entirely limited to the sister island, and the brunt of the outbreak fell upon Dublin. Other localities affected were Tullamore, Parsonstown, Mitchelstown, Thurles, Clondalkin, and the Curragh camp. The cases were not very numerous in Dublin; and in the country towns they were comparatively few. It is noteworthy that, as in the earlier outbreaks in France, the military in Ireland, in proportion to their strength, suffered prominently from the disease. In some of the country districts cases were recorded among the troops alone, or among persons in immediate connection with them.[8] In January and February 1867, an outbreak of a disease characterized by severe rigors, tetanic convulsions, intense neuralgic pain in the head and upper part of the trunk, increased sensitiveness of the surface, obstinate vomiting, restlessness, and, in one instance at least, by a dark purple eruption, but of which not a single case died, took place at Bardney, in Lincolnshire, a village about ten miles east of Lincoln, on the verge of a fen country, and having a population of 1500, the bulk of whom are engaged in agricultural pursuits.[9] Two cases of epidemic cerebro-spinal meningitis were recorded in London in the summer of 1867. One, a case of the fulminant form of the malady, in which death occurred in twenty-seven hours, took place in

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[1] Mr. Henry Gervis, Medico-Chirurgical Society's Transactions, vol. ii.

[2] Dr. John Scott, Medical Times and Gazette, 1865, vol. i. p. 515.

[3] Social Science Review, May, 1865, p. 398.

[4] Dr. McDowell, The London Journal of Medicine, 1851, vol iii. p. 858.

[5] Dr. Kennedy, The Medical Press and Circular, June 12, 1861, p. 551.

[6] The Lancet, April 15, 1865, p. 389.

[7] Clinical Histories and Comments, 1866, pp. 3–7.

[8] Dr. E. D. Mapother, and Staff-surgeon Dr. Jeffrey A. Marston, The Lancet, July 6 and July 13, 1867.

[9] G. M. Lowe, M.B. The Lancet, June 26, 1867, p. 790; Mr. Geo. Newman Woolley, The Lancet, Aug. 3, 1867, p. 130.

June,[1] the other, a case of the purpuric form, in which death occurred in seven days, took place in July.[2]

The peculiarity of distribution of the disease in the British Islands, its epidemic manifestation being limited to one portion of the kingdom, and chiefly, even in recurrent outbreaks, to a small section of the population of that portion, is not an isolated phenomenon. Notwithstanding the wide geographical prevalence of the malady as shown by the foregoing details, it must not be concluded that this prevalence represents a general diffusion of the disease among the different populations during the periods of its activity. The outbreaks of epidemic cerebro-spinal meningitis, as a rule, are limited to small sections of a population, and its distribution is by a series of isolated outbreaks, rather than by extensive spreading. This was shown remarkably, as already described, during the outbreak in France in 1837 and following years, when the ravages of the malady were principally confined to certain garrisons, and even to small sections of a garrison, without affecting the surrounding population. A like limitation of the disease to certain detachments of troops was observed during the recent war in the United States; and the restriction of the malady to small portions of workhouse populations, as in the first outbreak in Ireland, is an analogous phenomenon. Perhaps the sole outbreak in which an extensive diffusion of the disease among a community has occurred was that in the province of Dantzic, in 1864–65. The tendency to reproduction in a locality, as in Dublin, was particularly observed during the great outbreak in France from 1838 to 1848, when the disease reappeared again and again among the forces in Bayonne, Versailles, and Avignon, notwithstanding changes of garrison. The freedom of England and Scotland from outbreaks of so widely spread a malady is very remarkable; particularly if the seeming occasional cases of the disease to which reference has been made are to be regarded as true examples.

ETIOLOGY.—(*a*) *Predisposing Causes.—Age.* The personal liability to the disease is not governed in any definite manner by age. In some epidemics children, in others young people, in others again adults of from thirty to fifty years, have suffered in greatest proportion.—*Sex.* Generally, and in some outbreaks very markedly, *males* are more liable to the disease than *females.—Profession.* During the outbreaks of the disease in France from 1837 to 1849, a peculiar proclivity to the disease was observed among soldiers. But in subsequent outbreaks in France, and wider-spread outbreaks elsewhere, no special liability to the disease was manifested among any vocation.—*Climate and Seasons.* In the Eastern hemisphere our knowledge of the disease is limited to Western and Central Europe and Algeria, the northern boundary of the district not passing beyond lat. 61° N., the southern not beyond lat. 35° N.—the one extreme closely approaching the arctic, the other the torrid zone. In the Western hemisphere the records of the malady are confined to the populous districts of the eastern division of the United States, from lat. 30° N. to lat. 48° N. It is noteworthy that the northern and southern limits of distribution in both hemispheres but slightly overlap the isothermal lines 5° and 20°. *Season* acts as an unquestionable and powerful predisposing cause of epidemic cerebro-spinal meningitis, which is especially a disease of the cold months. Of 216 local outbreaks in France and the United States, 166 prevailed between December 1st and May 31st; 50 in the other six months of the year. In Sweden of 417 local outbreaks, 311 took place in the former period of the year, 106 in the latter (STILLÉ). During the recent outbreak in Ireland, the brunt of the disease fell between January and July, 1867. Of 85 outbreaks in various parts of Europe and the United States, dated by Hirsch, 33 prevailed in winter, 24 in winter and spring, 11 in spring, 1 in spring and summer, 2 in summer, 1 in summer and autumn, 1 in autumn, 1 in autumn and winter, 3 in autumn, winter, and spring, and 6 prevailed throughout the whole year.—*Locality and soil* do not exercise any manifest influence over the disease. It has been observed on low grounds, highlands, and on soils of the most various character indifferently.—*Sanitary conditions.* No definite relation exists between the sanitary state of habitations and of individuals and the occurrence of the disease. It has prevailed in some epidemics as well among the affluent as the impoverished—among those who are well-fed, well-housed, and well-clothed, as among those who are ill-fed, ill-housed, and insufficiently clothed. In certain outbreaks, as in that on the Lower Vistula, the prosperous classes suffered to a much less extent from the malady than the poor and miserable who were subjected to privation and much foulness of persons, dwellings, and atmosphere.

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[1] Dr. Edwards Crisp, The Lancet, June 22, 1867, p. 773.

[2] Dr. Thomas Clark, The Lancet, July 13, 1867.

(*b*) *Exciting Causes.*—Fatigue has been mentioned as an exciting cause. In some of the early outbreaks of the disease among French troops, France being at war at the time, fatigue apparently exercised a determining influence. Again, during the recent outbreak in Ireland, the malady appeared very early among a "flying column" of troops occupied in the suppression of the Fenian disturbance, and exposed to great fatigue and inclemency of weather. But fatigue has played little or no part in determining the disease among the civil population, especially among children and the inmates of work-houses and prisons.—*Cold.* The marked predominance of the disease in the winter and spring months has suggested a causal connection with cold. Hirsch has submitted the question to a detailed examination, and with this result: that, although the suspicion cannot be excluded that the temperature of winter and spring may have some direct effect upon the genesis of the disease, "the modifications in the mode of living incidental to these seasons exert, in a far higher degree an influence favourable to the presence of this as of many other infectious maladies."[1]—*Certain Insanitary States.* There is not any constant or even common relationship between any insanitary state and the appearance of the disease. Neither foulness of house and its surroundings, nor of the atmosphere, whether from putrid emanations or from overcrowding, nor impurity of any other kind, has any determinate relation with epidemic cerebro-spinal meningitis. But Hirsch remarks[1] of the outbreak in the province of Dantzic in 1865, that "the disease prevailed exactly in that season of the year in which, on account of inclement weather, many individuals were crowded together into small and dirty rooms kept constantly closed by their occupants, and from which all ventilation was excluded, and in which the before-mentioned unfavourable hygienic conditions [dampness, great filth, and an atmosphere loaded with putrid emanations] were extremely perceptible." The causes here suggested have been held to be not altogether inoperative in other and more circumscribed outbreaks.—*Communication of the sick with the well.* The great majority of observers have come to the conclusion that the disease is incommunicable from the sick to the well. Among the minority who hesitate to accept this deduction without reservation are Professor Hirsch, Professor Stokes, and Mr. J. Simon. The facts which suggest the possibility of the active cause of the disease being portable in some way are of the following character: (*a*) A child was seized with epidemic cerebro-spinal meningitis, and died. A second child of the same family was attacked with the malady a few days later. The day following the attack of this child, the mother, who slept in the same bed with it, sickened of the disease.[2] (*b*) 1. On the 8th February, 1865, a youth, aged 20 years, was attacked with the characteristic symptoms of epidemic cerebro-spinal meningitis. He was nursed by a woman from another village. The youth died, and after his death the woman returned home. She soon sickened, and she died of the epidemic disease on the 26th February. There had been but one case previously in the village. To the interment of the woman, the funeral obsequies, as customary in the district, being performed with the coffin open, came a family from another locality. After the return home of this family, a child, three months old, sickened immediately of meningitis and died within twenty-four hours. Then a man who had accompanied the family to the interment was attacked with the disease, and died on the 2d of March. Lastly a girl, in the same locality, who had also been at the funeral, was seized, and died on the 7th March. 2. At another village, two children of one family, aged three and a half and one and a half years respectively, died of the epidemic, one on the 27th January, the other on the 7th February. The clothes of the deceased were taken to a neighbouring village, and came into the possession of a girl aged five years. She soon sickened of the epidemic, and died on the 14th February.[3] (*c*) Boudin relates instances of the appearance of the disease in garrisons, and among the civil population of towns, after the introduction of detachments of troops among whom the disease had prevailed or was prevailing at the time.

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[1] Transactions of the Epidemiological Society, vol. ii. p. 369.

The foregoing facts simply suggest the possibility of the active cause of epidemic cerebro-spinal meningitis being communicable by the sick to the well. This possibility, notwithstanding the apparent formidable array of facts to the contrary, is not to be lightly dealt with. The lesson taught by the difficulties and doubts which beset the discovery of the communicability of typhoid fever and of cholera will have been strangely misunderstood if it is necessary to urge upon observers the importance of keeping the question of the possible communicability of epidemic cerebro-spinal meningitis constantly before the mind. In the consideration of this question, however, a caution is needed. The term "contagion" is used too indiscriminately. It has been so long employed to express the manner of transmission of disease which is witnessed in smallpox, scarlet fever, or typhus, that it is difficult to dissociate the idea of this manner from the word. It is almost impossible in reading the opinions of those writers who have come to the conclusion that epidemic cerebro-spinal meningitis is not a "contagious" disease, to avoid the suspicion, from their use of the adjective, that they have looked upon the question too exclusively from the point of view suggested by the diseases named. It is obvious that contagiousness of a like character to that of smallpox, scarlet fever, or typhus, is not possessed by the malady under consideration. The question is: Does epidemic meningitis, like typhoid fever or cholera, possess a peculiar contagiousness of its own, a property of communicability peculiar to itself? This has yet to be solved. Another explanation of the facts which appear to indicate a possible communicability of the disease from the sick to the well is, however, open, and is set forth in the next paragraph.

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[1] Transactions of the Epidemiological Society, vol. ii. p. 372.
[2] Professor Stokes, The Medical Press and Circular, June 19, 1867, p. 581.
[3] Hirsch, Transactions of Epidemiological Society, vol. ii. p. 373.

Diseased grain.—Dr. B. W. Richardson has suggested that epidemic cerebro-spinal meningitis may possibly arise from the consumption of diseased grain, after the manner of ergotism, and perhaps acrodynia. He thinks that the probabilities are altogether in favour of the suggestion, that "the cause, in fact, is a diseased grain, or fungus, contained in some kinds of flour out of which the bread-stuffs are made. This fungus may not be present in large quantities, and many persons may eat of the food without getting a poisonous part; but one will get it out of a number, and this without any communication beyond the breaking of bread together: the disease may occur in one member of a family, leaving the rest free, and in this irregular way it may be distributed, in an epidemic form, over a large surface of the country." He adds, "If my hypothesis, as regards cause, be correct, there is little danger of the disorder extending widely in this country; for of our cereals used as food, nearly the whole of the population now select wheat, and our wheat generally is selected for the market with great judgment and circumspection. Any cases, therefore, that might occur would be isolated, and would be easily traced out and prevented."[1] This suggestion opens out an altogether new field of inquiry respecting the origin of the disease, and it demands active and thoughtful consideration in subsequent outbreaks. Dr. H. Day, of Stafford, has endeavoured, by experiments on the lower animals, to obtain some light on the subject. He fed three rabbits with unsound grain (wheat, oats, ergot of rye, and mouldy bread) with this result: In all the animals a spasmodic affection was produced, and in two inflammatory changes in the right eye, proceeding in one case to ulceration of the cornea, and evacuation of the contents of the globe. One of the rabbits died on the eighth day, the other two were killed on the twelfth day, and in all more or less congestion of the membranes of the spinal cord was found on dissection.[1]

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[1] Social Science Review, May, 1865, p. 403.

The sum of our knowledge of the etiology of epidemic cerebro-spinal meningitis is this; that the clue to its explanation has not been discovered.

NATURE.—1. *Is the disease malarious, as suggested by some writers?* The outbreaks in which the disease has occurred in malarious districts, or in which the malady has shown an intermittent character, are too few in number to admit of much, if any, doubt resting upon the answer. There is no sufficient ground for believing that the malady is of malarious origin. The numerous examples of prevalence of the disease in localities free from malaria set the question aside definitely. Even when intermissions or remissions have been observed in the progress of the malady, it must not be hastily assumed that they are consequent upon malarious poisoning. Hirsch has shown that certain cases of epidemic cerebro-spinal meningitis, distinguished by intermissions and remissions, which came under his observation, took place in the course of an outbreak in a district free from malaria. Further, he states that this outbreak prevailed at a season (winter) and in a state of climate (intense cold) which notoriously exclude the prevalence of malarious diseases, even where endemic; that the period of life (1—5 years) least liable to malarious disease furnished the largest contingent of victims, while the classes most advanced in life, and who are most liable, escaped the epidemic in a remarkable degree. Finally, the infallible test of malarious disease, quinine, by its inutility in cases of the epidemic which assumed an intermittent or remittent character, showed the non-malarious nature of the affection.[2] 2. *Is epidemic cerebro-spinal meningitis a form of, or allied to, typhus?* Epidemic cerebro-spinal meningitis differs from typhus in the aspect of the patient, rhythmical progress, range and course of temperature, form of cerebral affection, character of eruption, sequelæ, rate of mortality, anatomical lesions, and manner of dissemination. Differing in all essential particulars, doubt can only arise when the two diseases prevail together. Under such circumstances, cases of the fulminant and purpuric forms of the one malady may be difficult to discriminate from the graver and more rapidly fatal forms of the other. Doubt also may arise when in the course of the former disease typhous or typhoid symptoms occur. But such a doubt applies equally to the discrimination of the disease from measles and typhoid fever, as from typhus. 3. *Is epidemic cerebro-spinal meningitis a true or a pseudo-epidemic disease?* Is this disease a true epidemic disease in the sense of its being due to a specific, febrile poison (to which class of diseases the term epidemic is now well-nigh alone restricted)? Or is it a pseudo-epidemic malady, as being an exaggerated and more prevalent form, from certain climatic conditions, of an idiopathic inflammatory affection of the brain and spinal cord? No absolute distinction can be drawn between sporadic cerebro-spinal meningitis and the epidemic malady of the same name. But there are certain broad and well-defined differences. The conjoined inflammatory affection of the covering membranes of the brain and spinal cord, which is the rule in epidemic cerebro-spinal meningitis, is a rare exception in sporadic inflammation of the envelopes of the central nervous centres. Again, the indications of blood-change which are so common in the epidemic disease are never, or only in most exceptional cases, witnessed in the sporadic disease. It has been suggested that the blood-change and herpetic and purpuric eruptions may be of nervous origin, and consequent upon the profound alteration in the nervous system. It has been suggested, also, that the purpuric eruption of epidemic cerebro-spinal meningitis may be one of several signs of a general tendency to purpura in disease, and merely an incidental phenomenon of the epidemic malady. Thus, in Dublin (1866–67), purpura had been observed in rheumatic fever,[1] and there was an outbreak of purpura among swine,[2] contemporaneously with the epidemic. The first suggestion touches a very curious question, which as yet does not admit of solution. But it is worthy of remark that the form of eruption which of all others is peculiar to epidemic cerebro-spinal meningitis is the *herpetic*, a form which, in some of its manifestations at least, as in herpes labialis, shingles, has singular neurotic relations. Mr. Jonathan Hutchinson has propounded the riddle, *Is herpes zoster an exanthem or neurosis?*[3] This is certain, that it is a symptom which has some definite connection with lesion of nerve trunks, if not nerve *centres*. The facts upon which the second suggestion is based are of interest, but they form too narrow a basis for conclusions. It is noteworthy that rare cases of cerebro-spinal meningitis are observed in the intervals of epidemic prevalence of the disease, even in this country (H. DAY; WILKS[4]). These cases are of much, although as yet undeterminate interest, in reference to the etiology of the disease. 4. *Is epidemic cerebro-spinal meningitis a disease, sui generis?* The association of symptoms shows that it is an independent malady; the aptitude to blood-changes in the course of the disease, judged by analogy with like changes which occur in acute specific diseases, suggests the inference that it is also dependent upon a specific poison, from whatever source derived. This is the deduction which appears to have the highest degree of probability in the present state of our knowledge.

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[1] Clinical Histories and Comments, pp. 18–23.

[2] Transactions of the Epidemiological Society, vol. ii. p. 377.

An intercurrent question arises here: Is the fulminant form of epidemic cerebro-spinal meningitis really a variety of the disease, or a different malady altogether? Dr. R. D. Lyons maintains that in the recent prevalence of the epidemic in Dublin, two independent diseases existed. The one characterized by its collapse, profuse purpuric eruption, great rapidity of course, fatality, and absence of anatomical lesion in the nervous centres after death, he designates *febris*

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[1] Dr. Banks, The Medical Press and Circular, June 19, 1867, p. 580.

[2] Dr. Mapother, The Lancet, July 13, 1867, p. 39.

[3] London Hosp. Reps., vol. iii. p. 70.

[4] The Lancet, April 15, 1865, p. 388.

nigra; the other was the disease commonly known as cerebro-spinal meningitis. But it is to be remarked that the two varieties of disease have never been observed except in the same epidemic; that they pass by insensible grades the one into the other; that the most highly developed symptoms of the so-called *febris nigra* sometimes occur together with the most marked symptoms of cerebro-spinal meningitis; and that it is more consistent with experience to consider the two series of symptoms as indications of one and the same malady, rather than two maladies going forward at the same time in the same patient. A second intercurrent question is, whether the purpuric form of the disease be of scorbutic origin? The question amounts to little more than a suggestion. There are no facts which support an affirmative answer; for, apart from other well known signs, purpuric spots are not indications of a scorbutic taint.

TREATMENT.—*Prophylactic.*—Ignorance of the true etiology of the disease limits our preventive efforts to general sanitary measures, applicable to all epidemic diseases, for the purification of houses and localities. Mr. J. Simon, recording the conditions under which the disease has prevailed, writes: "I am strongly of opinion that the best sanitary precaution which in the present state of knowledge can be taken against the disease, must consist in care for the ventilation of dwellings." He adds, however, "that in some cases, according to local reports, the distribution of an epidemic has very decidedly not been governed by conditions of overcrowding and ill-ventilation." Dr. B. W. Richardson's suggestion as to the cause of the disease should lead to the careful microscopic examination of all bread stuffs and farinaceous preparations in use among families and communities where the disease breaks out, and the disuse of such as may be of doubtful character.

Curative.—The treatment of epidemic cerebro-spinal meningitis is as unsatisfactory as that of cholera. The evidence of the course of the disease having been beneficially affected in any outbreak by the administration of medicine is very doubtful. The too common rapid progress of the malady to death, as in cholera, and the nature of the lesions determining death, necessarily set at naught efforts to control it; medicine not being guilty either of inaptitude or inactivity. The control of this disease, as of cholera or trichiniasis, is a question of preventive rather than curative treatment, and must depend upon the discovery and limitation of its cause. In the earlier outbreaks, epidemic cerebro-spinal meningitis was treated as an acute inflammatory affection, by bleeding and purgatives, with the general result that the fatality of the malady was probably invariably augmented. During the recent outbreak in Philadelphia, it was found that, in the more asthenic cases, cupping the nape of the neck was "of essential service in mitigating, and generally, indeed, in wholly removing the neuralgic pains which form so prominent and so severe a symptom in many cases of the disease" (STILLÉ). When the state of the patient forbade the abstraction of blood, dry-cupping used in the same locality afforded signal relief, and rendered the effects of vesication more prompt and complete. This was the experience of one of the least fatal outbreaks recorded. The experience of the majority of epidemics has been against any bloodletting, local or general. The deduction to be derived as to depletion from the general state of the circulation and the results of practice entirely coincide. For, as a rule, the pulse from the very outset contraindicates the withdrawal of blood; and, if in any case it should seem from the general symptoms that depletion might exercise some control over the central mischief, a thoughtful regard should be given to the future. The application of *cold* to the head and spine, either by means of ice or a freezing mixture, in Esmarch's India-rubber bags, is not open to the same objection as bloodletting, and has furnished by far the most satisfactory results of all direct treatment of the acute cerebro-spinal symptoms. In its use care should be taken not to prolong the application so as to depress or increase the depression already existing of the whole system. When the acute nervous symptoms are accompanied by marked prostration, it is advisable during the application of the ice to swathe the limbs in hot flannels, pack the legs and thighs with hot-water bottles, or bags filled with hot sand or salt, and cover the abdomen with thick layers of flannel or cotton-wool. From the very outset of the disease, care should be taken to economize the temperature of the body, and anticipate its fall; and in cases characterized by collapse, or much vital depression, the application of external heat in the manner just suggested is a cardinal point of treatment. Of medicaments directly addressed to the nervous symptoms, *opium* is the most valuable. It is especially indicated when there are much restlessness, acute delirium, sleeplessness, hyperæsthesia, and painful spasm. *Morphia* is the best form of administration, and subcutaneous injection perhaps the best mode. The drug should be given in decided and frequently repeated doses, and carefully watched. Stillé says of its use during the recent outbreak in Philadelphia: "We were in the habit of giving one grain of opium every hour, in very severe, and every two hours in moderately severe cases, and in no instance was produced either narcotism, or even an approach to that condition. Under the influence of the medicine the pain and spasm subsided, the skin grew warmer, and the pulse fuller, and the entire condition of the patient more hopeful. It seemed probable, however, that the full benefit of the opium treatment could be received by those only who were subjected to it in the early stages of the attack. Direct experience is here in perfect accord with the expectation which a knowledge of the pathological processes involved in the disease would naturally suggest."

A Committee of the American Medical Association has reported favourably of the *sulphate of quinia* in large doses, given at the very beginning of the disease. In some instances the drug seemed to abort the attack. The committee speaks also of the favourable results reported from the combined use of *ergot* and *chloride of iron*. Some American physicians have given *ergot* in combination with *belladonna*, and *belladonna* in combination with *quinine*, but with equivocal benefit. *Mercurials* have been freely used, particularly in the form of *calomel*, but their effect has been most questionable, except as purgatives.

Their indiscriminate use is to be utterly condemned, and their use at all to be discountenanced. A host of other medicaments have been made use of, of which it is requisite to note only *iodide of potassium*, *bromide of potassium*, and *arsenite of potash*. The circumstances under which the two former drugs have been used, and are most likely to prove beneficial, will suggest themselves to the practitioner. It does not appear that any decided good has arisen from their administration. In protracted cases of convalescence the arsenite of potash may prove a valuable remedy.

Of the general treatment of the patient the hot bath (102°–103°) is, when practicable, the most important. This should be followed, as recommended by the Committee of the American Medical Association, by friction with warm oil of turpentine. The *regimen* should be generous and nutritious from the beginning of the disease. In the acute stages soup of some kind or other, or milk, is needed; and as soon as appetite returns, *solid* viands of any digestible character must be given. In the graver cases where there is much restlessness and spasm or stupor, and food cannot be given by the mouth from the patient's refusal or inability to swallow, an attempt should be made to administer it by the rectum: when there is much thirst, the patient's fierce desire for drinks may be freely indulged. The state of the pulse is the principal guide to the use of *stimulants*. Their administration as a special remedy independently of the indications which generally govern their use has not been followed by good results; but they are called for when the condition of the pulse and the aspect of the patient show manifest flagging of the vital power. The *sequelæ* of the disease must be treated on ordinary principles.

Too frequently the state of the patient as to delirium, spasm, and irritability of the stomach prevents all internal treatment whether by medicine or food, and limits the efforts of the physician to external measures, restricting even their application. To this unhappy combination of unfortunate and uncontrollable conditions may reasonably be attributed to some extent the inefficacy of treatment.

BIBLIOGRAPHY.—In addition to the references in the text may be noted: The Eighth Report of the Medical Officer of the Privy Council, containing Mr. J. Simon's Memorandum on the Disease, and Dr. J. Burdon Sanderson's Report on the Epidemics prevailing about the Lower Vistula in the beginning of 1865.—Discussion in the Medical Society of the College of Physicians of Ireland; The Medical Press and Circular for May 29th, June 5th, 12th, and 19th, 1867.—Transactions of theAmerican Medical Association, vol. xvii., 1866, containing a Report of a Committee on the Disease.—Dr. W. H. H. Githen's Notes of 98 cases; The American Journal of the Medical Sciences, July, 1867.—Dr. S. Gordon; Dublin Quarterly Journal of Medicine, May, 1867.—Dr. C. Murchison; The Lancet, 1865, vol. i. p. 41.—Prof. A. Hirsch, Handbuch der historisch-geographischen Pathologie, 1866, vol. i. p. 163; Die Meningitis Cerebro-spinalis Epidemica vom historisch-geographischen und pathologisch-therapeutischen Standpunkte, 1866.—Dr. Stillé, Epidemic Meningitis or Cerebro-spinal Meningitis,

8vo., 1867, Philadelphia. This work contains a very copious bibliography, particularly valuable for its references to American monographs.—G. Tourdes, Histoire de l'Epidémie de Meningite Cérébro-Spinale observée à Strasbourg en 1840 et 1841. Paris, 1842.—J. Ch. M. Boudin, Traité de Géographie et de Statistique Médicales et des Maladies Endémiques, vol. ii. p. 564; Paris, 1857.—Consult Hirsch's great work and monograph.

III.

NEURITIS AND NEUROMA.

By J. Warburton Begbie, M.D., F.R.C.P.E.

Morbid appearances, the results of inflammatory action, are occasionally met with in nerves. Such are the consequences usually of injury; the nerves have been divided by a sharp instrument; or, if independent of wounds, they are in all probability connected with rheumatism or gout. There seems no reason to doubt that inflammatory action may likewise extend to nerves from the contiguous tissues.

In its general characters Neuritis resembles the inflammation of fibrous tissue. The fibrous investing sheath of nerves, or neurilemma, is indeed its usual seat; the appearances of inflammatory action being for the most part limited to it, and only seen in the form of red softening of the nervous tissue itself when the inflammation has been of an intense description.

A doubt as to the spontaneous occurrence of Neuritis has been entertained and expressed by several authorities. Boerhaave, for example, writes: "Nemo forte unquam vidit inflammationem in nervo; hæc vero si contingat, in sola *tunica vaginali* hæret."[1] Others, again, with even greater inaccuracy, have maintained the frequent existence of Neuritis.[2] Pathologically the inflammation of nerves may be acute or chronic; and these two conditions are described by Rokitansky as follows: The marks of the former (acute) are—(*a*) Injection and redness. The injection presents a linear arrangement, and the redness is partly caused by injection, and partly by small extravasations. (*b*) Looseness, succulence, and swelling of the nervous cord, due to infiltration of serum into the tissue of the neurilemma, and into the sheaths between the primitive nervous filaments. The nerve has lost its smooth, white, glistening appearance; its neurilemma is opaque, and has a rough and wrinkled look. (*c*) Exudation. This is generally a grayish or yellowish-red gelatinous product, which sooner or later becomes firm. It occupies the sheath and tissue of the neurilemma, and is likewise effused between the primitive filaments themselves. (*d*) The cellular tissue around the nervous cord always participates in these changes; it becomes injected, reddened, and infiltrated with a serous or sero-fibrinous fluid. Not only the neighbouring cellular tissue, but the sheaths of the muscles, the fascia, the subcutaneous cellular tissue, and the general integuments, become involved.

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[1] De Morbis Nervorum.

[2] See on this point Animadversiones de Neuritide. Praxeos Medicæ Universæ Præcepta, auctore Josepho Frank; Partis secundæ volumen primum, Sectio secunda. p. 131: also Elements of General and Pathological Anatomy, by David Craigie, M. D., p. 379.

Such a degree of inflammation as that now described may terminate in *resolution*, occurring quickly or slowly in different cases, or in *induration* of the nerve, and a permanent loss of its function in whole or in part. If the latter be the result, the nerve continues thickened, and more or less misshapen, forming a grayish cord, which is sometimes marked with black pigment and crossed by varicose vessels. The nerve filaments diminish in size and finally disappear, this result being in part due to the pressure to which they are exposed by the inflammatory product, and in part to their interrupted nutrition, for the vessels are obliterated by the inflammatory process. (*e*) In a more intense inflammation the primitive nervous filaments are destroyed. They are found in a state of red or grayish or yellowish-red softening, while the neurilemma is easily torn. (*f*) The fluid product of the inflammation may be purulent; and if so, the nerve appears highly discoloured, and infiltrated with purulent fluid tinged with blood. The neurilemma is then much altered, and readily gives way, while the nerve is converted into a yellowish-red, brownish-red, or chocolate-coloured pulp. The cellular tissue surrounding the nerve becomes infiltrated with yellow fibrinous exudation, and abscesses are formed in its course. (*g*) Ulcerative destruction of the nerve is the next step. But if the progress of inflammation be stayed before that point is reached, granulations appear, which become progressively changed into cicatrix tissue, as is observed in the stump of a nerve after amputation. Nerves, however, resist for a lengthened period the suppurative and sanious destruction which may be going on around them.

Chronic Inflammation is characterized by the varicose state of the vessels of the affected nerve, by products which become indurated, and gradually increase in quantity, and by a change of the nerve to a slate or lead-gray colour. Sometimes the products are not deposited uniformly throughout the nerve, and then nodular swellings are formed on it.[1] Romberg, when directing attention to the anatomical knowledge we possess of sciatica, speaks of Neuritis being found, but of its rare occurrence.[2] The same writer, however, refers to the possible production of Neuritis, by the sciatic plexus being dragged and irritated by the head of the child in a difficult labour. Valleix and Beau have described inflammation of nerves more systematically than other authors. The latter has at considerable length, in his interesting memoir on the subject, directed attention to "Intercostal Neuritis."[3] Reference has been made to the occurrence of a rheumatic or gouty Neuritis. Dr. G. B. Wood considers it to be highly probable that in a large proportion of cases rheumatism lies at the foundation of the disease.[4] And Dr. Garrod, while admitting, according to the usually received notion, that the nervous affections occurring in connection with gout are generally functional, believes them sometimes to be dependent on inflammatory action, which, he adds, appears, so far as can be ascertained, to have the character of true gouty inflammation.[1]

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[1] A Manual of Pathological Anatomy, by Carl Rokitansky. Sydenham Society's Translation, vol. iii. p 462.

[2] Lehrbuch der Nervenkrankheiten des Menschen. Neuralgie des Huftnerven.

[3] Valleix, Guide du Médecin Praticien, t. iv. p. 299; also Traité des Névralgies. Beau, Archives Générales de Médecine, 4e série, t. xiii. 1847.

[4] A Treatise on the Practice of Medicine, vol. ii. p. 843.

The most characteristic symptom of Neuritis is pain, not limited to the precise seat of the inflammation, but felt in the course of the nerve, and sometimes to its minutest branches. Besides its severity, the pain in Neuritis possesses other distinctive features; it is darting, and tingling, and there often accompanies it a feeling of numbness. The pain has been further described as intermittent, but is more probably remittent, being, as long as the disease continues, never entirely absent. Tenderness over the affected nerve invariably exists. It is possible that in some forms of local palsies (*see* Local Paralysis from Nerve Disease) the loss of power, partial or complete, as well as the existence of various morbid sensations, of which formication is one, and perhaps the most common, is due to disorganization or other permanent change in the trunk of a nerve, resulting from inflammatory action.

It seems to be generally admitted that the nerve most liable to such change is the sciatic: but the various branches of the brachial plexus, and especially the ulnar nerves, likewise suffer; and so in all probability do at times the other nerves in both lower extremities and trunk.

That inflammation may also attack the nerves of special sense, as Dr. Wood has conjectured, seems not improbable, particularly the nerves of hearing and of sight. Most assuredly a true gouty inflammation, apparently commencing, in some cases, in the nerves themselves, not unfrequently either damages or entirely destroys one or other of the delicate organs connected with these most important functions.

In the treatment of Neuritis the probable alliance of the affection with some peculiar diathetic condition, the gouty or rheumatic, or possibly with the syphilitic cachexia, must not be lost sight of.

Local abstraction of blood, and the application of emollient and anodyne poultices, rest, low diet, and the use of laxatives, are the chief remedies in cases of the acute Neuritis. When the disease is chronic, the use of blisters, issues, and even the cautery, have been recommended. Internally, besides opium or other narcotic for the relief of pain, it will be prudent to give a fair trial in both the acute and chronic Neuritis to quinine, and colchicum, the iodide and the bromide of potassium.

NEUROMA (Tumour of Nerve).—Growths of various sizes and natures occurring in the course of nerves had been described before the term Neuroma came to be applied to such. Dr. Robert Smith, in his valuable and elaborate memoir, makes a brief reference to the early history of the subject;[2] and so likewise does Mr. William Wood, in his important papers entitled, "Observations on painful Subcutaneous Tubercle," and "On Neuroma."[3] The famous English surgeon, William Cheselden, is specially mentioned as having given the first accurate account of the nervous tubercle, which has become familiar chiefly through the writings of Mr. wood. "Immediately under the skin, upon the shin bone, I have twice seen little tumours, less than a pea, round and exceeding hard, and so painful that both cases were judged to be cancerous: they were cured by extirpating the tumour. But what was more extraordinary was a tumour of this kind, under the skin of the buttock, small as a pin's head, yet so painful that the least touch was insupportable, and the skin for half an inch round was emaciated: this, too, I extirpated with so much of the skin as was emaciated, and some fat. The patient, who before the operation could not endure to set his leg to the ground, nor turn in his bed without exquisite pain, grew immediately easy, walked to his bed without any complaint, and was soon cured." The same writer describes and figures the cystic neuroma. "A tumour formed in the centre of the cubital (ulnar) nerve, a little above the bend of the arm; it was of the cystic kind, but contained a transparent jelly; the filaments of the nerve were divided and ran over its surface. This tumour occasioned a great numbness in all the parts that nerve leads to, and excessive pain upon the least touch or motion. This operation (for the removal of the tumour) was done but a few weeks since; the pain is entirely ceased, the numbness a little increased, and the limbs as yet not wasted."[1]

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[1] The Nature and Treatment of Gout and Rheumatic Gout, p. 517.

[2] A Treatise on the Pathology, Diagnosis, and Treatment of Neuroma. Dublin, 1849.

[3] Transactions of the Medico-Chirurgical Society of Edinburgh, vol. iii. pp. 317 and 367.

The term Neuroma, or rather *Neuromes*, was first employed by M. Odier of Geneva. "Enfin," writes Odier, "on peut donner le nom de Neuromes à ces tumeurs mobiles, circonscrites et profondes, qui sont produites par le gonflement accidentel d'un nerf, à l'extrémité duquel la compression de la tumeur fait éprouver des crampes très pénibles."[2]

There have been various classifications of neuromatous tumours attempted by pathologists, such as local and general—that is, as affecting one nerve, or several nerves; and, again, those which are the direct consequence of a morbid process, and those resulting from an original vice of conformation. Dr. Smith, rejecting these divisions, has suggested, as sufficient for practical purposes, that Neuromata should be considered as of two kinds: 1st, of spontaneous origin, or *Idiopathic;* 2d, as the result of wounds or other injuries of the nerves, and there fore *Traumatic.*

Before offering a brief description of these varieties, it may be well to direct attention a little more fully to the *painful subcutaneous tubercle*, which we have the authority of Dr. Hughes Bennett and other pathologists for stating "must be referred to this class of tumours,"[3] that is, neuromatous fibrous tumours.

"Although," remarks Dr. Smith, "pathologists have hitherto failed to discover anything like nervous structure in these tumours, I still incline to the opinion that they are connected with the minute filaments and ultimate ramifications of the nerves. Upon any other supposition it is, I conceive, impossible to offer a rational explanation to account for the dreadful severity of the sufferings which they induce." Mr. Paget, who has carefully examined the "painful subcutaneous tumours," describes them as being formed of "either fibro-cellular or fibrous tissue, in either a rudimental or a perfect state." Alluding to a case described by the late Professor Miller, in his "Principles of Surgery," and by Professor Bennett, the same pathologist admits that their structure may sometimes be fibro-cartilaginous.[1]

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[1] The Anatomy of the Human Body, 12th edit., London, 1784, pp. 136 and 256.

[2] Manuel de Médecine. Pratique ou Sommaire d'un Cours gratuit, donné en 1800, 1801, et 1804, aux Officiers de Santé du département du Léman, par Louis Odier, Paris, 1811, p. 362.

[3] Clinical Lectures on the Principles and Practice of Medicine. 3d edit. p. 171.

Of this affection the first detailed account was given by the late Mr. William Wood, of Edinburgh. After the publication of Mr. Wood's earlier papers,[2] cases were recorded by different observers, and in 1829 an instructive *résumé* of the whole subject was laid by him before the Medico-Chirurgical Society of Edinburgh, and appeared, as already mentioned, in its "Transactions."

This disease consists in the formation of a small lump or tubercle seated in the subcutaneous cellular tissue, immediately under the integuments, which retain their natural appearance. The tubercle is met with in different parts of the body, but most frequently in the extremities. It is extremely small, pisiform in shape, of firm consistence, and apparently quite circumscribed.

The characteristic feature of the disease is the occurrence of violent pain coming on paroxysmally. The paroxysms vary in duration from ten minutes to upwards of two hours, their frequency as well as intensity appearing to increase in precise relation to the length of time the disease has existed. Some patients enjoy intervals of relief from pain for days or even weeks, while others have repeated attacks in the course of a single day. The paroxysms of pain frequently occur when the patient has fallen asleep. They are also apt to be excited by various external causes, such as pressure and blows; while in rarer instances mental disquietude and atmospheric changes have been their only apparent occasion.

Females are more frequently the subjects of this disease than males. Wood, referring to thirty-five cases collected by him, mentions that twenty-eight were females, five males; and in the account of two the sex was not stated. Of thirteen cases quoted by Descot, ten occurred in females, and three in males. Romberg has met with three instances, all in females.

The situation of the tubercle in the thirty-five cases referred to by Wood was as follows: in the lower extremities in twenty-two, in the upper extremities in eleven, in the chest in one, and in one in the scrotum. In only two of these cases was there more than one tubercle present.

This disease does not seem to be intimately connected with any particular period of life, as it has been noticed at all ages from thirteen to above seventy.

"It is a happy circumstance that this very painful affection is capable of being remedied by a very simple operation. The tubercle is easily removed by a single incision, and it is unnecessary to take away any portion of the integuments, or of the surrounding cellular tissue. No bad effect can follow the removal of the little body."—*Wood.*

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[1] Lectures on Surgical Pathology, vol. ii. p. 123.

[2] The Edinburgh Medical and Surgical Journal, 1812. Two articles, pp. 285 and 429.

Although this subcutaneous tubercle has been considered as a variety of Neuroma, it must be held in remembrance that, its distinct connection with branches of nervous trunks never having been determined, this is more a matter of inference than of demonstration. Ollivier and Rayer together carefully dissected the tumour in a case to which reference is made in his latest paper by Wood, and the result is thus expressed: "Extérieurement il était enveloppé de tissu cellulaire, dans lequel nous ne pûmes distinguer aucun filet nerveux, même à l'aide d'une forte loupe."[1] Paget remarks that the general opinion is against the supposition of the intimate connection of these painful tumours with nerves. "Dupuytren," he writes, "says that he dissected several of these tumours with minute care, and never saw the smallest nervous filament adhering to their surface. I have sought them with as little success with the microscope. Of course I may have overlooked nerve-fibres that really existed. It is very hard to prove a negative in such cases; and cases of genuine Neuroma, *i.e.*, of a fibrous tumour within the sheath of a nerve, do sometimes occur, which exactly imitate the cases of painful subcutaneous tumour."

We have now to consider the first of the two forms of Neuroma, as distinguished by Smith, and now generally recognized, namely, the *Idiopathic Neuroma.* Tumours of this nature are of an oval or oblong form, their long axis corresponding with the direction of the nerve to which they are attached. They vary considerably in size. One figured in his work by Smith is as small as a grain of wheat, while another is as large as a good-sized melon. Between these two extremes every variety of size occurs. There may be only one, or several may be found on the same nerve; occasionally they are found simultaneously upon all the spinal nerves. "In number," says Rokitansky, "they vary from one until they are almost countless." A remarkable general disease is thus constituted, of which three cases have been observed in the Vienna Hospital. Neuromata are comparatively rare in the ganglionic system. But although occurring most frequently on the spinal nerves, neuroma is not limited to them; the cerebral nerves, motor as well as sensory, particularly those most closely resembling the nerves of the cord, present at times the same tumours.

In general, neuromata are solid throughout their entire structure but in some instances are of cystic formation, as in the case recorded by Cheselden, and already referred to. These tumours are of slow growth, but continue to undergo a steady increase in size, although many years may elapse before they attain such dimensions as to prove a source of serious inconvenience. They are movable in the transverse direction, but not in the course of the nerve upon which they are seated. There may be a difficulty in distinguishing tumours which are merely contiguous to nerves from the true Neuroma, having its origin within the neurilemma. Wood has specially alluded to this difficulty in diagnosis, and Smith has pointed out that the non-nervous tumours, unlike Neuromata, are generally movable in all directions, and when drawn away from the nerve, cease to be painful on pressure.

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[1] Traité théorétique et pratique des Maladies de la Peau, seconde édit., t. ii. p. 290. Paris, 1835.

Nerve tumours are described by Rokitansky as lying between the fasciculi of the nerves, and interwoven with their neurilemmatous sheath. Neuroma, the same pathologist observes, is never deposited in the centre of a nerve, but at its side, so that only a small part of its fasciculi is displaced; the displaced fasciculi are spread abroad and stretched over the tumour, while the greater mass of the nerve remains on the other side uninjured, and with its fibres in connection with one another.

The solid neuromatous swellings are of a tough elastic consistence, of grayish or pale yellowish-red colour, and are invested with a distinct fibrous sheath. Dr. Hughes Bennett thus describes them: "On being minutely examined, they are found to consist of fibrous texture more or less dense, the filaments often arranged in wavy bundles running parallel to each other, but occasionally assuming a looped form, or intercrossing with each other. I have also found them to contain groups of cells. Not unfrequently they are fibro-cartilaginous; sometimes with the cells closely aggregated together, and at others widely scattered. In some of the neuromatous swellings described by Dr. Smith I found the fibrous tissue to present wavy bundles, among which a few granule and cartilage cells were scattered and shrivelled, apparently from the action of spirit."[1]

Neuromata seldom contract adhesion to the investing integuments, unless they have been subjected to continued pressure. Smith has never known them to suppurate, or to be removed by absorption. Pain has been generally considered to be a characteristic feature of neuromatous swellings. In this respect, however, there is infinite variety. When a single Neuroma exists, there is almost invariably much suffering. The pain, moreover, occurs suddenly and paroxysmally, darting along the nerve with the violence and instantaneousness of an electric shock. On the other hand, in those examples of Neuroma which are distinguished by the number of the tumours it is not uncommon to find these occasioning little or no inconvenience to the patient.

It is exceedingly difficult to determine with anything like exactness the real cause of the paroxysmal attacks and sudden aggravation of severe pain which occur in this as well as in many other forms of disease of the nervous system. Mental emotions and the ordinary atmospherical vicissitudes have been generally assigned as the occasion of these occurrences in Neuroma.

Paget has some very interesting observations on the cause of pain in

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[1] Loc. cit., p. 171

Neuroma, as well as on the nearly entire absence of all suffering which has been noticed in some cases; and founding on the observations of Smith and others, including himself, this excellent writer is no doubt correct when he states, "that we cannot assign the pain in these cases entirely to an altered mechanical condition of nerve-fibres in or near the tumour. We must admit, though it be a vague expression, that the pain is of the nature of that morbid state of the nerve force which we call *neuralgic*. Of the exact nature of this neuralgic state, indeed, we know nothing; but of its existence as a morbid state of nerve-force, or nervous action, we are aware in many cases in which we can as yet trace no organic change, and in many more, in which the sensible organic change of the nerves is inadequate to the explanation of the pain felt through them." In short, Paget argues for the pain being functional, and not necessarily dependent at least on an organic disorder. If such pain is found to be influenced by the remedies chiefly available for the relief of ordinary neuralgia—quinine, iron, arsenic, belladonna, stramonium, the bromide of potassium—this suggestion will receive corroboration.

We now know that such Neuromata as are the seat of severe pain and of continual irritation may give rise to attacks of the so-called sympathetic epilepsy. Instances of this nature are to be found in the writings of several authors, and it is sufficient here to refer to the well-known views of Brown-Séquard respecting the exciting causes of the epileptic convulsion, and of many other nervous affections.[1]

In the idiopathic form of Neuroma the pain is generally limited to the parts below the tumour; and the sign of the true Neuroma, signalized by Aransoohn, has been accepted by others—namely, that when the trunk of the nerve is compressed above the tumour the pain ceases, and then the Neuroma, previously acutely sensitive, can be touched without any uneasiness being caused. The remark already made as to the solid variety of Neuroma not being necessarily painful applies likewise to the fluid or cystic tumour.

Our knowledge of the determining causes of Neuroma cannot be said to have advanced since the period when the important treatise of Dr. Smith first appeared, and we are still compelled to adopt his expression, "I feel it must be confessed that we know nothing with certainty regarding the causes of Neuroma."[2]

Neuromatous tumours have been frequently removed along with the corresponding portion of the nerve on which they were situated; and such operations, while entirely relieving the patients from suffering, have not been succeeded by any considerable loss of sensibility, or of the power of voluntary movement, in the parts supplied by even large nerves.

The sciatic nerve may be divided, as in a case of severe neuralgia of that nerve, by M. Malagodi, and a portion of it excised, without permanently destroying the functions of the limb.

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[1] Researches on Epilepsy, p. 35; also Course of Lectures on the Physiology and Pathology of the Central Nervous System, p. 181. Article, Neuroma, by the same Author, in Holmes's System of Surgery, vol. iii. p. 96.

[2] Loc. cit., p. 5.

The magnitude of the nervous trunk, which is the seat of the disease, will of course largely determine the period at which complete or partial restoration of the function in the limb is established. In some cases a few months, in others a year and upwards, have elapsed; but sooner or later, in all recorded instances, the banished sensibility and motor power have been regained.

The interference with the calorific function of the nervous system is strikingly exhibited in cases of operation for Neuroma. Mr. Adams and Dr. Smith have drawn attention to the diminution of temperature in the limb after the removal of the tumour, and with it a portion of nerve—a diminution readily noticed both by patients and operator, and which has lasted for a lengthened period, even after the restoration of the other functions.

It may then be concluded that when idiopathic Neuroma is seated in the hand, forearm, or upper arm (the positions in which it has most commonly been found), the operation for removal may be safely practised. It is possible that a similar plan might be adopted in the case of Neuroma in the lower extremity; but it is on record that amputation of the limb has been had recourse to by Chelius, in a case of nervous tumour occupying the popliteal space and stretching to nearly the centre of the back of the thigh. This was an illustration; and there are others which teach a similar lesson, of the disease having been permitted to attain a very large size—so large as to prevent any attempt being made for its simple removal.

TRAUMATIC NEUROMA.—Under this division are to be included tumours of nerves resulting from any form of mechanical injury, such as wounds, blows, pressure, or following amputation.

Traumatic Neuroma is almost invariably single. The tumour is the seat of intense pain, which, unlike the suffering in the idiopathic form of the disease, is not confined to the growth itself, or felt merely by the parts below it, but is frequently found extending along the nerve towards its origin. When Neuroma occurs as a consequence of a wound of nerve, it usually consists of a solid tumour, not invested in neurilemma, and destitute of any distinct capsule.[1] It is most likely to form when the nervous cord has been cut, but not entirely divided; and cases of this nature are even more than ordinarily painful.

The following case is published by Mr. Wood in his "Memoir on Neuroma;" it occurred in the practice of Mr. Syme:—

"James Muir, aged 43. *30th June*, 1828.—On the inner side of the left knee, about a hand-breadth above the joint, there is a narrow depressed cicatrix, two inches long. Between this cicatrix and the sartorius there is a small tumour, about the size of an almond, and of very firm consistence. When the limb is extended, this tumour can hardly be perceived, being then overlapped by the sartorius; but when the knee-joint is bent, it can be felt very distinctly. It is most movable in a lateral direction, but seems pretty firmly connected to the subjacent parts by condensed cellular substance.

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[1] Smith, loc. cit., p. 20.

"The patient states that the tumour is always painful when pressed, but is more so at one time than another. The pain is not confined to the part, but shoots all over the knee, and sometimes extends from the groin to the toes. He observes that the pain is more severe during cold or damp weather. It frequently, for days together, prevents him from walking, or even resting on the limb. His story is, that when a boy, about eleven years old, he strained his knee by jumping into a saw-pit, which led to the formation of a large abscess that opened on both sides of the knee, namely, at the part where the cicatrix above mentioned still remains, and exactly opposite, where also there is a similar cicatrix. Several small bits of bone were discharged, and at the end of two years he got quite well. For the following twenty-seven years he led an active life; ten of them were spent in a militia regiment. About eight years ago he strained his knee while walking in his garden, and thereafter became subject to flying pains about the joints. These pains induced him to rub the knee frequently; and in doing so, about two years ago, he noticed the tumour. It was then the size of a pea, and has gradually enlarged. The disagreeable symptoms also have become greatly aggravated; and, as he refers them all to the tumour, he is desirous of having it removed.

"*12th July.*—Mr. Wood (continues Mr. Syme), who was kind enough to examine the patient, having agreed with me that the tumour was seated on or in the nervus saphenus, and that it ought to be removed, I performed the operation, with his assistance, on the 1st of July.

"The tumour being divided showed a firm fibrous capsule containing a soft brownish-white pulpy matter. The nerve was traced into the tumour, but not through it. The patient made a good recovery, and remains free from his complaint."[1]

The foregoing case illustrates the proper treatment of Traumatic Neuroma, which is to excise the tumour with the corresponding portion of nerve, in every case when its situation will permit of this being done.[2]

The last form of Neuroma which requires any separate consideration is that succeeding to amputations. Smith remarks in regard to such, that "their existence is so constant that we may, perhaps, consider them as representing the normal condition of the ends of the nerves in stumps." Generally they cause no uneasiness whatever; but on the other hand, they have occasionally been the occasion of severe neuralgia, occurring in paroxysms of great length.

The Neuroma of stumps varies in size, being in some instances not larger than a garden-pea, in others as large as a grape, or even plum. Such Neuromata are generally of an oval or oblong form, of grayish-white color, and of a firm dense texture.

The situation of the Neuroma in the stump is not always the same; it may be several inches above the surface of the latter, and be connected with the cicatrix by means only of a fibrous cord, itself destitute of any nervous structure.

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[1] Loc. cit., p. 426.

[2] Smith, p. 22.

It is the opinion of some pathologists, that the Neuromata, succeeding amputation are produced by the pressure which is exerted upon the surface of the stump. An objection fatal to this explanation, however, has been advanced—namely, that in many stumps which have never been subjected to pressure these little tumours are found.

Dr. Smith believes their formation to be for the protection of the extremity of the nerve.

IV.

NEURALGIA.

By Francis Edmund Anstie, M.D., F.R.C.P.

Definition.—A disease of the nervous system manifesting itself by pains, nearly always unilateral, which appear to follow the course of particular sensory nerves. The pains are usually sudden in their commencement, and of a darting, stabbing, boring, or burning character; they are at first unattended with any local change which can be recognized, or by any constitutional pyrexia. They are always markedly intermittent; sometimes regularly and sometimes irregularly so. The periods of intermission are distinguished by complete freedom from acute suffering, and in recent cases, the patient appears quite well at these times. In old-standing cases, however, persistent tenderness and other signs of local mischief are apt to be developed in the tissues which surround the distribution of the nerves which are the seat of the acute pains. Severe attacks of Neuralgia are usually complicated with secondary affections of other nerves which are intimately connected with that which is the original seat of pain; and in this way congestion of bloodvessels, hypersecretion, or arrested secretion from glands, inflammation and ulceration of tissues, &c., are sometimes brought about.

Synonyms.—The word Neuralgia has a generally recognized force, and there is no equivalent to it (except foreign variations in mere terminology) which represents the whole group of disorders to which it applies, though there are numerous phrases for particular forms of the disorder.

Clinical History and Symptoms.—These vary so greatly in different cases of Neuralgia that it will be necessary to discuss the greater part of this subject under the headings of the special varieties of the disease. There are certain features, however, which are observed in all true Neuralgias.

In the first place, it is universally the case that the existing condition of the patient at the time of the first onset of the disease is one of debility, either general or special. I make this statement with great confidence, notwithstanding the contrary assertion advanced by so high an authority as Valleix, whose able[1] treatise really laid the foundation for all our accurate knowledge of the Neuralgias.

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[1] Traité des Névralgies. Paris, 1841.

In the first place, it is certainly the case that the larger half of the total number of patients coming under my care with various forms of Neuralgia are either decidedly anæmic or have recently undergone some exhausting illness or fatigue: and the reason why Valleix did not find so many cases of this type among his neuralgic patients appears certainly to be, that he limited the neuralgic class of diseases by an artificial definition, which we shall have to reject as untenable. On the other hand, although a considerable number of neuralgic patients are so far healthy in appearance, that they have a fairly ruddy complexion and a good amount of muscular strength, it is impossible to admit that these facts disprove the existence of debility, either structural or functional, *in the nervous system*, for the commonest experience teaches that such debility does not frequently coexist with a great robustness and development of the apparatus of vegetation and the lower forms of animal function. And it will invariably be found, on carefully examining these apparently robust neuralgic patients, that the nervous system has given warnings of its weakness; thus, the patient who, after an exhausting confinement, attended with great loss of blood, is attacked with obstinate *clavus hystericus*, will inform us that whenever in earlier life she had suffered from headache, the pain was always chiefly, if not altogether, confined to the nerves which are now the seat of decided Neuralgia. In a large number of cases I have also found that the attack of acute pain was immediately ushered in by a remarkably *anœsthetic* condition of the parts about to become painful; and a slighter degree of blunted sensation may often be observed in the intervals between the earlier attacks in cases of Neuralgia. In short, I have never seen a case of neuralgic pain in which there were not marked evidences of nervous debility, either local or general.

Another circumstance is common to all Neuralgias of superficial nerves; and as a large majority of neuralgic affections are superficial in situation, this is, for practical purposes, a general characteristic of the disease. I refer to the formation of *tender spots* at various points where the affected nerves pass from a deeper to a more superficial level, and particularly where they emerge from bony canals, or pierce fibrous fasciæ. So general is this characteristic of inveterate cases, that Valleix founded his diagnosis of the genuine Neuralgias on the presence of these painful points, in which assumption I think there can be little doubt that he committed an error.[1]

The third general characteristic of neuralgic affections is, that the pain is intermittent, or at the least remittent, in every stage of the disease.

The fourth general characteristic is, that fatigue and every other temporary depressing influence directly predisposes to an attack of acute pain, and aggravates it when already existent.

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[1] Trousseau insists with much energy that a still more important "point douloureux" is constantly present in Neuralgia, viz. over the spinous processes of one or more vertebræ, corresponding to the origin of the painful nerve. It is true (as the Brothers Griffin had long before pointed out), that there is *tenderness* in this situation. But this "point apophysaire" is not always, nor frequently, the seat of *spontaneous pain*.

VARIETIES.—It is possible to classify the Neuralgias upon either of two systems: first (A), according to the constitutional condition of the patient; and, secondly (B), according to the situation of the affected nerves. It will be necessary to follow both these lines of classification, avoiding repetitions as much as possible.

(A) In considering the influence of constitutional states upon the typical development of Neuralgia, it will be convenient to commence with (I) the group of cases in which the general state of the organism exerts the least amount of effect. This is the case where the pain is the result of direct injury to the nerve-trunk, whether by external violence, by the mechanical pressure of a tumour, or by the involvement of a nerve in inflammatory or ulcerative processes, spreading to it from neighbouring tissues. As regards the development of symptoms, the important matters are, that the pain in these cases commences comparatively gradually, that the intermissions are usually much less complete, and that the pain is far less amenable to relief from remedies than in other varieties of Neuralgia. The little that can be said about the form which is dependent upon progressively increasing pressure or involvement of a nerve in malignant ulcerations, caries of bones, or teeth, &c., falls under the heads of Diagnosis or Treatment, and need not detain us here. The clinical history of Neuralgia from external violence, however, requires separate discussion.

1. Neuralgia from external violence may be produced by a shock (as of a fall, a railway collision, &c.), which gives a jar to the central nervous system, or by severe mental emotion, operating upon the same part of the organism. Under either of these circumstances the development of the affection seldom occurs at once, but ensues after a variable interval, during which the patient exhibits symptoms of general depression, with loss of appetite and strength. Sometimes vomiting, and even, in other instances, actual paralysis of a partial and temporary kind occur. When once developed the neuralgic attacks are undistinguishable from those which occur from causes internal to the organism. The affection is usually very obstinate. In a large, number of cases the nerve or nerves affected have previously shown signs of weakness, by a tendency to painful affection in depressed states of the organism. In the greater number of instances, as far as my experience goes, it is the fifth cranial nerve which becomes neuralgic from the effects of central shock. Illustrative cases will be given in the sections on local classification.

2. Neuralgia from direct violence to superficial nerves is produced either by cutting or, more rarely, by bruising wounds.

Cutting wounds may divide a nerve-trunk, (α) partially, or (β), completely.

(α) When a trunk-nerve is partially cut through, neuralgic pain commonly occurs, if at all, immediately on the receipt of the injury. One such example only has come under my own care, but many others are recorded.[1] In this case the ulnar nerve was partly cut through with a tolerably sharp bread-knife, at a point not far above the wrist; partial anæsthesia of the little and ring fingers was induced, but at the same time violent neuralgic pains in the little finger came on, in fits recurring several times daily, and lasting for about half a minute. Treatment was of little apparent effect in promoting cure, though opiates gave temporary relief, as did the local use of chloroform. The attacks recurred for more than a month, long after the original wound had healed soundly; and for a long time after this pressure on the cicatrix would reproduce the attacks. A slight amount of anæsthesia still remained when I last saw the patient, more than a year after the injury.

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[1] Vide Lancet, 1866.

(β) Complete severance of a nerve-trunk is a sufficiently common accident, far more common than is the production of Neuralgia from such a cause; indeed, so marked is this disproportion between the injury and the special result, that I have been led to the conclusion that a necessary factor in the chain of morbid events must be the existence of some antecedent peculiarity of organization in the central origin of the injured nerve. This opinion is rendered more probable by the fact that the consecutive Neuralgia is not unfrequently situated not in the injured nerve itself, but in some other nerve with which it has intimate central connections. Two such examples are recorded in my Lettsomian Lectures,[1] in which the ulnar nerve, and one in which the cervico-occipital, respectively, were completely divided: in all three instances the Neuralgia was developed in the branches of the trigeminus. In all the cases which have come under my notice the Neuralgia, whether direct or reflex, set in at a particular period, viz., after complete cicatrization of the wound, and while the functions of the branches on the peripheral side were partly, but not completely, restored. The same obstinacy and rebelliousness to treatment was noticed as in other instances of Neuralgia from injury.

A few words must be given before quitting the subject of Neuralgia from wounds of nerves, to the cases in which a foreign body lodges, with more or less laceration, in the substance of a nerve-trunk. I have never seen such a case; but many instances are recorded in which most violent and painful Neuralgia has been set up in this way. Not unfrequently the irritation produces no noticeable effect on the nerve actually pressed upon, but sets up Neuralgia in a nerve so distant that no connection is suspected between the neuralgic pain and the original accident. The removal of a small piece of glass, or such other irritating body from the cicatrix of an old wound has in several recorded instances put an end to neuralgic pains in quite another situation, for which all manner of remedies had long been tried. Sometimes the neuralgic pain has been accompanied by tissue degeneration of an alarming character, and these have likewise ceased at once upon the removal of the peccant body which had been the unsuspected source of the evil.

Neuralgias which result from some local injuries of so peculiar a character as *gunshot wounds* scarcely fall properly within the province of this article. The reader who desires to know all that can be said with regard to this particular class of affections is recommended to study the able and carefully compiled "Report" of Messrs. Mitchell, Morehouse, and Keen.[1]

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[1] Vide Lancet, 1866.

The case of Neuralgia from injury, pressure, and local disease of nerves has been mentioned first, because this form of the disease is less influenced than others by general constitutional states. But it is an erroneous opinion, however common, that the general condition of the body is here without any influence on the development of the nerve-pain. It has been forcibly urged, by Dr. Brinton and Dr. Handfield Jones more especially, that a condition of general bodily vigour mitigates, and that constitutional debility decidedly aggravates, these forms of Neuralgia; and my own experience gives most practical proof of the justice of this argument.

(II.) *Neuralgias of intra-nervous origin.*—As regards the constitutional conditions with which the several varieties of Neuralgia that arise independently of external violence, or disease of extra-nervous tissues, are respectively allied, the following preliminary subdivision may be made:—

1. Neuralgia of malarious origin.
2. Neuralgias of the period of bodily development.
3. Neuralgias of the middle period of life.
4. Neuralgias of the period of bodily decay.
5. Neuralgias associated with anæmia and mal-nutrition.

1. *Neuralgias of malarious origin* were formerly far more prevalent than they are at present, within the sphere of the English practitioner of medicine; with the general decline of malarial fevers, consequent on improved drainage and cultivation of lands, they have become constantly more scarce. In former times, on the contrary, they were so common, that they forced themselves on the notice of every physician. The term "brow-ague," to this day applied by many medical men to every variety of supra-orbital Neuralgia, is a relic of the older experience on this point; as is also the very common mistake of expecting all neuralgic affections to present a distinctly rhythmic recurrence of symptoms.

My own experience of malarial Neuralgia has been very limited, and I may as well say all that I know of its symptoms at once. In fact, though the out-patient practice of the Chelsea Dispensary and Westminster Hospital has afforded me a considerable number of examples of ague in past years, I have only seen two undoubted and one doubtful case of malarial Neuralgia, in all of which the fifth nerve was affected. The periodicity in one of the genuine cases was regular tertian; in the other regular quotidian. An algide condition always ushered in the attacks; but this was gradually exchanged, as the pain continued, for a condition in which the pulse was rapid, soft, and bounding, and the strength was further depressed. In both of these cases there were unilateral flushing of the face, and congestion of the conjunctiva, to a slight degree, during the attack of pain. The pain became duller and more diffused contemporaneously with the lowering of arterial pressure (as estimated by Marey's Sphygmograph); and after the disappearance of active pain, moderate tenderness over a considerable tract around the course of painful nerves remained for some time. But there was no distinct development of the *painful points* of Valleix (to be hereafter described), a circumstance which I attribute to the rapid cure of the complaint, in each instance, by quinine.

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[1] Report on Gunshot Injuries to Nerves, observed in the late American War, Philadelphia, 1864.

2. *Neuralgias of the period of bodily development.*—By the "period of bodily development" is here understood the whole time from birth up to the twenty-fifth year, or thereabouts. This is the period during which the organs of vegetative and of the lower animal life are consolidating. The central nervous system is more slow in reaching its fullest development, and the brain more especially is many years later in acquiring its maximum of organic consistency and functional power.

That portion of the period of bodily development which is antecedent to puberty is but little obnoxious to neuralgic affections. From the moment when puberty arrives, however, all is changed. In the stir and tumult which pervades the organism, and especially in the enormous diversion of its nutritive and formative nisus to the evolution of the generative organs and the correlative sexual instincts, the delicate apparatus of the nervous system is apt to be overwhelmed, as well as left behind, in the race of development. Under these circumstances the tendency to neuralgic affections rapidly increases. It will, however, be seen later that there is a great preponderance of particular varieties of the disease among the cases occurring during this period.

3. *Neuralgias of the middle period of life.*—By this period is meant the time included between the twenty-fifth and about the fortieth or the forty-fifth year. It is the time of life during which the individual is subjected to the most serious pressure from external influences. The men, if poor, are engaged in the absorbing struggle for existence and for the maintenance of their families; or, if rich and idle, are immersed in dissipation, or haunted by the mental disgust which is generated by *ennui.* The women are going through the exhausting process of child-bearing, and supporting the numerous cares of a poor household in some cases, or are devoured with anxiety for a certain position in fashionable society for themselves and their children, or again they are idle and heart-weary, or condemned to an unnatural celibacy. Very often they are both idle and anxious.

It must not be supposed that there is a sharp line of demarcation between this period and the last: nevertheless it will be seen, when we come to discuss the local varieties of Neuralgia, that there are certain broad differences in the general tendencies of the two epochs. It must be noted that particular Neuralgias, which are first manifested in the development period, frequently recur, under special provocation, in the period of middle life.

4. *Neuralgias of declining bodily vigour.*—The period here referred to is that which commences with the first indications of distinct physical decay, of which the earliest that we can recognize (in persons who are not cut off by special diseases) is perhaps the tendency to atheromatous change in the arteries. The earliest development of this

symptom varies very considerably in date; but whenever it occurs it is a plain warning that a new set of vital conditions has arisen; and especially notable is its connection with the characters of the neuralgic affections which take their rise after its commencement. The period of declining life is pre-eminently the time for *severe and intractable* Neuralgias. Very few patients indeed are ever permanently cured, who are first attacked with Neuralgia after they have entered upon what may be called the "degenerative" period of existence.

Perhaps a separate heading should be reserved for those Neuralgias which are the heralds of locomotor ataxy. But they seem naturally to fall under the present class, although the nervous degeneration which produces them is chiefly in the direction of sclerosis. The character of these pains is fully described in the article on Locomotor Ataxy.

5. Neuralgias which are immediately excited by anæmia or malnutrition. Of the neuralgic affections which can be ranked within this group, the sole characteristic worthy of note here is the circumstances in which they arise. It would seem that conditions of anæmia and mal-nutrition simply aggravate the tendencies of existing weak portions of the nervous system to be affected with pain; just as they notoriously do aggravate lurking tendencies to convulsion and spasms.

(B.) We come now to the consideration of local varieties of Neuralgia. The primary subdivision of these may be made as follows:—

(I.) Superficial Neuralgias. (II.) Visceral Neuralgias. The superficial Neuralgias may be subdivided thus:—

(*a*) Neuralgia of the fifth (trifacial or trigeminal).
(*b*) Cervico-occipital Neuralgia.
(*c*) Cervico-brachial Neuralgia.
(*d*) Intercostal Neuralgia.
(*e*) Lumbo-abdominal Neuralgia.
(*f*) Crural Neuralgia.
(*g*) Sciatic Neuralgia.

This classification is taken from Valleix, and appears to me substantially correct.

(*a*) The most important group of Neuralgias are those of the fifth cranial nerve.

Neuralgia of the fifth nerve always exhibits itself with especial violence in certain foci, which Valleix was the first to define with accuracy. These foci are always in points where the nerve becomes more superficial, either in turning out of a bony canal, or in penetrating fasciæ. In the ophthalmic division of the nerve the following possible foci are noticeable: (1) the *supra-orbital*, at the notch of that name, or a little higher in the course of the frontal nerve; (2) the *palpebral*, in the upper eyelid; (3) the *nasal*, at the point of emergence of the long nasal branch, at the junction of the nasal bone with the cartilage; (4) the *ocular*, a somewhat indefinite focus within the *globe* of the eye; (5) the *trochlear*, at the inner angle of the orbit.

In the superior maxillary division the following foci may be found: (1) the *infra-orbital*, corresponding to the emergence of the nerve of that name from its bony canal; (2) the *malar*, on the most prominent portion of the malar bone; (3) a vague and indeterminate focus, somewhere on the line of the gums of the upper jaw; (4) the superior *labial* point, a vague and not often an important focus; (5) the *palatine* point, rarely observed, but in some recorded cases the seat of intolerable pain.

In the inferior maxillary division the foci are: (1) the *temporal*, a point on the auriculo-temporal branch, a little in front of the ear; (2) the *inferior dental* point, opposite the emergence of the nerve of that name; (3) the *lingual* point (not a common one) on the side of the tongue; (4) an *inferior labial* point, only rarely met with.

Besides these foci in relation with distinct branches of the trigeminus there is one of especial frequency, which corresponds to the *inosculation of various branches.* This is the *parietal* point, situated a little above the parietal eminence. It is small in size, the point of the little finger would cover it. It is the commonest focus of all.

Neuralgia of the fifth may attack any one, or all three of the divisions; the latter event is comparatively rare.[1] The most common is the case of its limitation to the ophthalmic division, and incomparably the most frequent foci of the pain are the *supra-orbital* and *parietal* points.

The most common of all the varieties of trigeminal Neuralgia is Migraine, or sick-headache. This is an affection which is entirely independent of digestive disturbances, in its primary origin, though it may be aggravated by their occurrence. It almost always first attacks individuals at some time during the period of bodily development. Under the influences proper to this vital epoch, and often of a further debility induced by precocious straining of the mental powers, the patient begins to suffer headache after any unusual fatigue or excitement, sometimes without any distinct cause of this kind. The unilateral character of this pain is not always detected at first; but as the attacks increase in frequency and severity, it becomes obvious that the pain is limited to the supra-orbital, and sometimes to the ocular branches of the ophthalmic division of the fifth nerve of one side. In very rare cases, however, as in all forms of Neuralgia, the nerves of both sides may be affected. If the pain lasts for any considerable time, nausea, and at length vomiting, are induced. This is followed at the moment by the increase of the severity of the pain; but from this point the violence of the affection begins to subside, and the patient usually falls asleep. The history of the attacks negatives the idea that the vomiting is ordinarily remedial. This symptom merely indicates the lowest point of nervous depression; but it may happen that a quantity of food which has been incautiously taken, lying as it does, undigested in the stomach, may of itself greatly aggravate the Neuralgia, by irritation transmitted to the medulla oblongata. In such a case vomiting may directly relieve the nerve-pain. When the patient awakes from sleep, the active pain is gone. But it is a common occurrence, indeed it always happens when the Neuralgia has lasted a certain length of time, that a *tender* condition of the superficial parts remains for some hours, perhaps for a day or two. This tenderness is usually somewhat diffused, and not limited with accuracy to the foci of greatest pain during the attacks.

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[1] It is with much diffidence that I make this statement, as it is opposed to the opinion of Valleix. But my own experience is very positive on the matter; and, besides, it appears to me that Valleix's definition of Neuralgia, which I cannot accept as sufficiently expansive, accounts for his views.

Sick-headache is not uncommonly ushered in by sighing, yawning, and *shuddering*—symptoms which remind us of the prodromata of some graver neuroses, to which it is probably related by hereditary descent.

Another variety of trigeminal Neuralgia which infests the period of bodily development is that known as *clavus hystericus; clavus* from the fact that the pain is at once severe, and limited to one or two small definite points, as if a nail or nails had been driven into the skull. These points correspond either to the *supra-orbital* or the *parietal*, sometimes both these are the seat of the pain. But for the greater limitation of the painful area in clavus, that affection would scarcely differ from migraine, for the former is also accompanied, when the pain continues long enough, with nausea and vomiting. The adjective *hystericus* is an improper and inadequate definition of the circumstances under which clavus arises. The truth is that the subjects of it are usually females who are passing through the trying period of bodily development; but there is no evidence to show that uterine disorders give any special bias towards this complaint. Both migraine and clavus are often met with in persons who have long passed the period of bodily development. But their first attacks have nearly always occurred during that period of life.

The adult or middle period of life is not, according to my experience, fruitful in *first attacks* of trigeminal Neuralgia. But when the neuralgic tendency has once been set up, there are many circumstances of middle-adult life which tend to recall it. Over-exertion of the mind is one of the most frequent; more especially when this is accompanied by anxiety and worry; indeed the latter is a more powerful cause than the former. In women, the exhaustion of hemorrhage at parturition, or of menorrhagia, and also the depression produced by over-lactation, are frequent causes of the recurrence of a migraine or a clavus to which they had been subject when young. The middle period of life is also most obnoxious, on the whole, to severe mental shocks, and also to severe bodily accident, of a kind to produce damage to the central nervous system. Special mention ought to be made in the case of women, of the disturbing influences of the great series of changes which close the middle period of their life—viz., the involution of the sexual organs. This is doubtless a very frequent cause of the resuscitation of a tendency to facial Neuralgia which had lain dormant, perhaps, for many years.

It is, however, the final, or degenerative period of life, which produces the most formidable varieties of facial Neuralgia. Neuralgias of the fifth which have previously attacked an individual, may recur at this time of life without any special character except a certain increase of severity and obstinacy. But trigeminal Neuralgias which now occur for the first time are usually intensely severe and utterly incurable. These cases correspond with the affection named by Trousseau, "tic épileptiforme," and it is of them, doubtless, that Romberg is speaking, when he says that the true Neuralgias of the fifth rarely occur before the fortieth year of life. These affections are distinguished by the intense severity of the pain, the lightning-like suddenness of its onset, and the almost total impossibility of effecting more than the most temporary improvement in the symptoms. But they are also distinguished by another circumstance which too often escapes attention; namely, they are almost invariably connected with a family taint of insanity, and very often with strong melancholy and suicidal tendencies in the patient himself, which do not depend on, nor are commensurate in their development with, the intensity of the pain which he suffers. They are further remarkable for the frequency with which they are attended with two special complications—viz., muscular spasms, and the formation of exquisitely tender points, the least pressure on which is enough to cause the most violent agony. Often, a mere breath of wind impinging on them will produce a like effect. The history of these cases is most wretched; the unfortunate patient may survive for years before he completely succumbs to exhaustion; yet every hour of his life is a misery. The act of masticating usually causes intolerable darts of agony, and nutrition is often obliged to be kept up by liquids. If mere broth and slop diet be adhered to, there is probably under-nutrition which aggravates the Neuralgia. And if, as often happens, the patient flies to drink as a relief, that again hastens the degeneration of the nervous centres, and renders the case more hopeless of cure than ever.

(*b*) *Cervico-occipital Neuralgia.*—As Valleix has remarked, there are several nerves (in fact the posterior branches of all the first four spinal pairs) which are more or less capable of being the seat of this affection. But amongst them all there is none comparable to the great occipital, which arises from the second spinal pair, for the frequency and importance of its Neuralgic affections. This nerve sends branches to the whole occipital and the posterior parietal region. On the other hand, the second and third spinal nerves help to make up the superficial cervical branch of the cervical plexus, which is distributed to the triangle between the jaw, the median lines of the neck, and the edge of the sterno-mastoid, and those to the lower part of the cheek. Then there is the auricular branch, which starts from the same two pairs, and supplies the face, the parotid region, and the back of the external ear. Then, the small occipital, distributed to the ear and to the occiput. And finally there are the superficial descending branches of the plexus. These, altogether, are the nerves which at various points, where they become more superficial, form the foci of cervico-occipital Neuralgia.

The most typical example of this form of Neuralgia which has fallen under my own notice, occurred (after exposure to cold wind) in a lady about sixty years of age, who had all her life been subject to Neuralgic headache, approaching the type of migraine, and who came of a family in which insanity, apoplexy, and other grave neuroses had been frequent. The pain centred very decidedly in a focus corresponding to the occipital triangle of the neck. It recurred at irregular intervals, and in very severe paroxysms, and was entirely unaffected by any remedies, till *blistering* was tried, when it yielded at once. About twelve months later this patient suffered a severe hemiplegic attack of paralysis.

The tendency, however, of cervico-occipital Neuralgias is certainly to spread towards the lower portions of the face, as observed by Valleix; in this case they become, sometimes, undistinguishable from Neuralgias of the third branch of the fifth. In the early stages of the disease, if the physician had been lucky enough to witness them, the true place of origin of the malady would have been easily discernible; at a later date it requires great care, and a very strict interrogation of the patient, to discover the true history of the disease.

Experience is too limited, if I am to judge by my own and that of the standard authors, to allow us to say anything of the conditions, as to age and general nutrition of the organism which specially favour cervico-occipital Neuralgia. Apparently, however, there is good reason for thinking that the immediately exciting cause of it is most frequently *external cold.* And I am inclined to think also that it is seldom a primary Neuralgia, but occurs usually in subjects who have already experienced other forms.

(*c*) *Cervico-brachial Neuralgia.*—This class includes all the Neuralgias which occur in nerves originating from the brachial plexus, as from the posterior branches of the four lower cervical nerves. The most important characteristic of the Neuralgias of the upper extremity is the frequency, indeed almost constancy, with which they invade simultaneously or successively several of the nerves which are derived from the lower cervical pairs. The neuralgic affections of the small posterior branches (distributed to the skin of the lower and back part of the neck) are comparatively of slight importance. But the "solidarité," which Valleix so well remarked, between the various branches of the brachial plexus, causes the Neuralgias of the shoulder, the arm, forearm, and hand to be extremely troublesome and severe, owing to the numerous foci of pain which usually exist. Perhaps Valleix's description of these foci is somewhat fanciful and over-minute; but the following among these which he mentions I have repeatedly identified: (1) an *axillary* point, corresponding to the brachial plexus itself; (2) a *scapular* point, corresponding to the inferior angle of the scapula. (It is difficult to identify the peccant nerve here: the one to which it apparently corresponds, and to which Valleix refers it, is the sub-scapular; but we are accustomed to think of this as a motor nerve). Still it is certain that pressure on a painful point existing here will often cause acute pain in the nerves of the arm and forearm. (3) A *shoulder* point, which corresponds to the emergence, through the deltoid muscle, of the superficial filets of the circumflex; (4) a *median-cephalic* point, at the bend of the elbow, where a branch of the musculo-cutaneous nerve lies immediately behind the median cephalic vein; (5) an *external humeral* point, about three inches above the elbow, on the outer side, corresponding to the emergence of the cutaneous branches which the musculo-spiral gives off as it leaves the groove in the humerus; (6) a *superior ulnar* point, corresponding to the course of the ulnar nerve, between the olecranon and the epi-trochlea; (7) an *inferior ulnar* point, where the nerve passes in front of the annular ligament of the wrist; (8) a *radial* point, making the place where the radial nerve becomes superficial at the lower and external aspect of the forearm. Besides these foci, there are sometimes, but more rarely, painful points developed by the side of the lower cervical vertebræ, corresponding to the posterior branches of the lower cervical pairs.

The most common seat of brachial Neuralgia in my experience has been the ulnar nerve; the superior and inferior points above mentioned being the foci of greatest intensity; an axillary point has also been developed in one or two instances which I have seen. Rarely, however, does the Neuralgia remain limited to the ulnar nerve, in the majority of cases it soon spreads to other nerves which emanate from the plexus. A very common seat of Neuralgia is also the shoulder, the affected nerves being the cutaneous branches of the circumflex. I am inclined to think, also, that affections of the musculo-spiral and of the radial near the wrist are rather common, and have found them extremely obstinate and difficult to deal with. One case has recently been under my care in which the foci of greatest intensity of pain were an external humeral, and a radial point; but besides this there was an exquisitely painful scapular point. In another instance, the pain commenced in an external humeral and a radial focus; but subsequently the shoulder branches of the circumflex became involved. A most plentiful crop of herpes was an intercurrent phenomenon in this case.

Median cephalic Neuralgia is an affection which used to be comparatively common in the days when phlebotomy was in fashion, the nerve being occasionally wounded in the operation. I have only seen it in connection with this cause; that is to say, as a well-marked affection. One such instance has been under my care. But a slight degree of it is not uncommon, as a secondary symptom in Neuralgia affecting other nerves. The traumatic form is excessively obstinate.

In the Neuralgias of the arm we begin to recognize the etiological characteristic which distinguishes most of the neuralgic affections of limbs, namely, the frequency with which they are aggravated, and especially with which they are kept up and revived, when apparently dying out, by *muscular movements.* In the case above referred to of Neuralgia of the sub-scapular, musculo-spiral (cutaneous branches), and radial, the act of playing on the piano for half an hour immediately revived the pains in fullest force, when convalescence had apparently been almost established.

The liability of particular nerves in the upper extremity to Neuralgia, from *external injuries*, requires a few words. The nerve which is probably most exposed to this is the ulnar. Blows on what is vulgarly called the funny bone are not uncommon exciting causes of the affection in predisposed persons: and cutting wounds of the ulnar a little above the wrist are rather frequent causes. The deltoid branches of the circumflex, and the humeral cutaneous branches of the musculo-spiral, are much exposed to injury. The radial nerve near the wrist is very much exposed both to bruises and to cutting wounds. So far as I know it is only when a nerve-trunk of some size is injured that Neuralgia is a probable result. Wounds of the small nervous branches in the fingers, for instance, are very seldom followed by Neuralgia. I have no statistics to guide me as to the effect of long-continued *irritation* applied to one of those small peripheral branches; but it is probable that that might be more capable of inducing Neuralgia. As far as my own experience goes, however, it would appear that a more common result is *convulsion* of some kind, from reflex irritation of the cord.

(*d*) *Dorso-Intercostal Neuralgia.*—This form of Neuralgia has of late years assumed a position of much interest, in consequence, chiefly, of its rather frequent association with unilateral herpes, a circumstance which has considerably helped to elucidate the pathology of the latter disease.

This disease is surrounded with considerable diagnostic difficulties. Some of these will be discussed under the heading of Diagnosis in part; but a few words must be given to them here. The disorder with which it is especially liable to be confounded is that for which Dr. Inman invented the term Myalgia, and which is represented in different localities by the affections called in old-fashioned phrase pleuro-dynia, lumbago, and (more generally) by the very inaccurate term muscular rheumatism (there being no respectable evidence whatever to connect it specially with the rheumatic diathesis). The principal feature by which dorso-intercostal Neuralgia can be separated from myalgia is its history; viz., its non-dependence, or much less dependence on *excessive or long-continued local muscular action* than the latter complaint exhibits. There is also a marked *intermittence* in the neuralgic affections. Finally, though this only applies to a limited number of cases, the intercurrence of *herpes* is a decided diagnostic of the neuralgic character of the disease.

Dorso-intercostal Neuralgia is an affection of certain of the dorsal nerves. These nerves divide immediately after their emergence from the intervertebral foramina into a posterior and an anterior branch. The former sends filaments which pierce the muscles, to be distributed to the skin of the back; the latter, forming the intercostal nerves, follow the intercostal spaces. Immediately after their commencement the intercostal nerves communicate with the corresponding ganglia of the sympathetic. Proceeding outwards they at first lie between the pleura and intercostal muscles; towards the angles of the ribs they pass between the two layers of intercostal muscles, and, after giving branches to the latter, give off their large superficial branch. In the case of the seventh, eighth, or ninth intercostal nerves, which are those chiefly liable to Neuralgia, the superficial branch is given off about midway between the spine and sternum. The final point of division, at which superficial filets come off, in all the eight lower intercostal nerves, is nearer to the sternum, and is progressively nearer to the latter in each successive space downwards. There are thus, as Valleix observes, three points of division: 1, at the inter-vertebral foramen; 2, midway in the intercostal space; 3, near to the sternum.

And there are three sets of superficial branches (reckoning the posterior primary division) which make their way towards the surface near these points.

In one of its forms, intercostal Neuralgia is one of the commonest of all neuralgic affections. I refer to the pain beneath the left mamma, which women with neuralgic tendencies so often experience, chiefly in consequence of over-lactation, but also from exhaustion caused by menorrhagia, and especially from the concurrence of this cause with the preceding one. Some care must be taken to distinguish this from the mere myalgic pain, which is produced by over-working the pectoral muscles in proportion to the existing state of their nutrition, and also by the vague conditions grouped under the name "Hysteria." The latter sort of pain is more diffuse in extent, and less markedly intermittent, than Neuralgia, and its history is different: and the effect of *rest* is far more marked in the former than in the latter.

It is only of recent years that the Neuralgia which had often been observed to attend herpes zoster has been even thought of as essentially connected with the latter disease. It is to M. Notta that some of the earliest observations leading to the latter view are to be attributed. But the matter was much more fully discussed by M. Barensprung, in a paper published in 1861.[1] This author showed the absolute universality with which unilateral herpes, wherever developed, closely followed the distribution of some superficial sensory nerve, and gave reasons, which will be discussed hereafter, for supposing that the disease originates in the ganglia of the posterior roots, and that the irritation spread thence to the posterior roots in the cord, causing reflex Neuralgia. This theory will be discussed further. Meantime, it seems to be established, by multiplied researches, that though unilateral herpes may, and often does, occur without neuralgia and neuralgia without herpes, the concurrence of the two is due to a mere extension of the original disease, which is a nervous one.

In young persons zoster is not often attended with severe *Neuralgia*, but a curious half-paretic state of the skin, in which numbness is mixed with formication, or with a sensation as of boiling water under the skin, precedes the outbreak of the eruption by some hours, or even a day or two. Painless herpes is commonest in youth. From the age of puberty to the end of life the tendency of herpes to be complicated with Neuralgia becomes progressively stronger. The course of events is different in different cases, however. Usually, in adult and later life, the symptoms *commence* with a more or less violent attack of neuralgic pain, which is succeeded, and for the time usually (though not always) displaced, by the herpetic eruption. This latter runs its course, and after its disappearance the Neuralgia very commonly returns again. In old people the *after*-Neuralgia is often distressingly severe, and most rebellious to treatment. Six weeks or two months is quite a common period for it to last, and in some aged persons it has been known to fix itself permanently, and cease only with life. In elderly subjects a further complication sometimes occurs. The herpetic vesicles leave obstinate and most painful ulcers behind them, which refuse to heal, and worry the patient frightfully, the merest breath of air upon them sufficing to cause agonizing darts of neuralgic pain. I have known one patient distinctly killed by the exhausting agony thus caused.

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[1] Annalen der Charité Krankenhauses zür Berlin, ix. 2, p. 40. Brit. and For. Med. Rev., January, 1862.

The foci of pain in intercostal Neuralgia are always found in one or more of the points, already mentioned, at which sensory twigs become superficial. In long-standing cases acutely tender spots are developed; not unfrequently the most decided of these are where they are too seldom sought for, namely, opposite the emergence from the intervertebral foramen.

(*e*) *Dorso-lumbar Neuralgia.*—The records of this affection are as yet in a state of considerable confusion. What has been done with any precision towards clearing up the history of the disease, related chiefly to the neuralgic affections of the pelvic organs in women; and to the Neuralgia of the testis in men, which will be treated of in a different place.

The principal foci of dorso-lumbar Neuralgia, when this affects external parts, are as following: (1) the *vertebral* points, corresponding to the posterior branches of the respective nerves; (2) an iliac about the middle of the crista ilii; (3) an *abdominal* point, in the hypogastric region; (4) an inguinal point in the groin near the issue of the spermatic cord, from whence the pain radiates along the latter; (5) a *scrotal* or *labial* point, situated in the scrotum, or in the labium majus.

Such is the description given by Valleix; and as I have seen but few examples of the external forms of dorso-lumbar Neuralgia I can only rely upon his observation. The few severe cases of this kind of Neuralgia, which I have observed, have been distinguished by foci in the vertebral region, and over the crista ilii; in two of these there were also distinct foci in the spermatic cord and testicle. In one patient there was an apparent focus of pain higher up in the groin also; but this man is a confirmed hypochondriac, and his morbid sensations are so shifting as to be very unreliable in their indications.

(*f*) The next group of Neuralgias which must be described is the crural. This, after all, includes very few independent cases. There are very few primary Neuralgias of the crural nerve; Valleix had only seen two in his very large experience, and I cannot say that I have seen any. Neuralgia of the crural nerve is almost always a secondary affection, arising in the course of Neuralgia, which primarily showed itself in the external pudic branch from the plexus.

(*g*) The last, and one of the most important and numerous groups of external Neuralgias are the femoro-popliteal, or Sciatic.

Sciatica is a disease from which youth is comparatively exempt. Valleix had collected 124 cases; and in not one was the patient below the age of seventeen; only 4 were below twenty. In the next decade there were 22; in the next 30; and the largest number of cases, 35, were between the ages of forty and fifty. This completely tallies with my own experience; and seems to favour the suspicion which I have formed, that the pressure exerted on the nerve in locomotion and in sitting is one principal cause of the great liability to Neuralgia which distinguishes the sciatic nerve; and this idea seems to be favoured by the further fact elicited by Valleix, that from thirty years onward the number of male is greatly higher than that of female sciatic patients.

There are three very distinct varieties of the disease, however, according to my experience. The first variety is obscure in its origin, but may be said, in general terms, to be connected with a strongly marked nervous temperament, which is indicated in the female by a tendency to hysteria, and in the male by an abnormal sensibility to nervous impressions. The subjects of this variety of sciatica are mostly below the age of forty, and have generally been liable to other forms of Neuralgia; the actual attack of sciatica is excited by some bodily fatigue or mental distress which, on other occasions, has produced sick-headache, or intercostal Neuralgia, &c. Very many of these patients are anæmic. The greater number of them are females, and in many (whether as cause or effect) there is decided amenorrhœa, and sometimes chlorosis. In this variety the pain, though chiefly affecting the sciatic nerve and its branches, is apt secondarily to invade some of the nerves which issue from the lumbar plexus. I cannot avoid the suspicion, though the proof is most difficult, that the affection not unfrequently depends on, or is much aggravated by, an excited condition of the sexual apparatus: certainly I have observed it with marked frequency in women who remain single long after the marriageable age, and in the case of several male patients there has been either the certainty or a strong suspicion of venereal excess. The actual outbreak of pain is generally sudden, but in many instances there has been a tendency to numbness, or abnormal sensations, in the skin of the back part of the thigh, or in some part of the course of the branches of the nerve for some time previously. Like all forms of sciatica, this affection is usually obstinate, and requires assiduous and sometimes prolonged treatment for its removal; but it is incomparably more manageable than other varieties.

The second variety of sciatica occurs for the most part in middle aged or old persons who have long been subject to excessive muscular exertion, or have been much exposed to cold, and especially *damp* cold, or who have been subjected to both of these kind of evil influences. One must include also, I think, in this group, a certain number of patients whose age need not be so advanced, but who have been liable, along with depressing influences of a constitutional kind, to prolonged pressure on the nerve from the habitual maintenance of the sitting posture, in their business, for many hours together.

The patients who suffer from this second variety of sciatica are mostly, as already said, of middle age or more; but this statement must be understood to be made in the comparative sense which refers rather to the vital condition of the individual than to the mere lapse of years. Many of them have hair which is prematurely gray: and in some the existence of rigid arteries, together with *arcus senilis*, completes the picture of organic degeneration. In particular cases where depressing influences have been at work for a long time, or unusually active, these appearances rectify the impression we should otherwise receive from learning the nominal age of an individual; this is especially the case with persons who have for a long time drunk to excess. I am at a loss to know how Valleix and many others can have overlooked the frequent occurrence of this type of constitution among the most numerous group of sciatic patients—those between thirty and fifty years of age: unless, indeed, we suppose that many of their "robust" patients were so fresh in colour and possessed such good muscular strength as to lead the physician to ignore the far more significant indications which are given by the above-mentioned appearances.

A prominent feature in this variety of sciatica is its great obstinacy and intractability. Another equally marked is the development, around one or more foci of severest pain, of spots which are permanently and intensely tender, and the slightest pressure on which is sufficient to renew the agony of acute pain: this development of tender points is far less marked in the preceding form of the disease. The places which are specially apt to present this phenomenon are as follows: (1) A series or line of points, representing the cutaneous emergence of the posterior branches, which reaches from the lower end of the sacrum up to the crista ilii. (2) A point opposite the emergence of the great and small sciatic nerves from the pelvis. (3) A point opposite the cutaneous emergence of the ascending branches from the small sciatic which run up towards the crista ilii. (4) Several points at the posterior aspect of the thigh, corresponding with the cutaneous emergence of the filets of the crural branch. (5) A *fibular* point, at the head of the fibula, corresponding to the division of the external popliteal. (6) An *external malleolar*, behind the outer ankle. (7) An *internal malleolar*.

Another circumstance which distinguishes the form of sciatica which we are considering, is the degree in which (above all other forms of Neuralgia) it involves paralysis. By far the largest part of the whole *motor*-nervous supply for the limbs passes through the trunk of the great sciatic; it might therefore be naturally expected that a strong affection of the sensory portion of the nerve would, in a reflex manner, produce some powerful effect on the motor element. This effect is most frequently in the direction of paralysis. Complete palsy is rare, but in a large number of cases which have lasted some time there can be no doubt that there is a positive and very considerable loss of motor power, independently of any effect which may be produced by wasting of muscles. It is of course necessary to avoid the fallacy which might be produced by neglecting to observe whether movement was merely restricted in consequence of its *painfulness*.

Anæsthesia is also a common complication of sciatica, far commoner as I venture to think, than it has been represented either by Valleix or Notta. It is necessary, however, to be explicit on this point. In the early stages both of this form of sciatica and of the milder varieties previously described, there is almost always partial numbness of the skin previous to the first outbreak of neuralgic pain, and during the intervals between the attacks. By degrees this is exchanged, in the milder form, for a generally diffused hyperæsthesia around the foci of neuralgic pain, while other portions of the limb may still remain anæsthetic. In the severer forms it sometimes happens that, besides an intense hyperæsthesia of the skin over the painful foci, there is diffused hyperæsthesia over a greater part or the whole of the surface of the limb. But it is important to remark that both in the anæsthetic and the hyperæsthetic conditions (so called), the *tactile sensibility is very much diminished.* I have made a great many examinations of painful limbs in sciatica, and have never failed to find (with the compass points) that the power of distinctive perception was very decidedly lowered.

Convulsive movements of muscles are met with in a moderate proportion of the cases of severe sciatica of middle and advanced life, in which affection they are entirely involuntary. They differ from certain spasmodic movements not unfrequently observed in the milder form (and especially in hysteric women), for these are more connected with defective volition, and are, in truth, not perfectly involuntary. In several cases of inveterate sciatica I have seen violent spasmodic flexures of the leg upon the thigh. Cramps of particular muscles are occasionally met with. I have seen the flexors of all the toes of the affected limb violently cramped; and in one case the patient was troubled with severe cramps of the gastrocnemius. It is chiefly at night, and especially when the patient is just falling asleep, that this kind of affection is apt to occur.

A third variety of sciatica is the rather uncommon one (so far as my experience goes) in which inflammation of the tissues around the nerve is the primary affection, and the Neuralgia is a mere secondary effect, from mechanical pressure on the nerve which, however, is apparently not itself inflamed. I believe that these cases are sometimes caused by syphilis, and sometimes by rheumatism. It need hardly be said that this affection is essentially different, and requires a different treatment from Neuralgias in which the disturbances originate in the nervous system.

(II.) *Visceral Neuralgias.*—This most important class of diseases still remains very much unknown; but it is constantly assuming a greater consequence. The Neuralgias of viscera, of which anything can with confidence be said, are the following: (1) Cardiac, (2) Hepatic, (3) Gastric, (4) Peri-uterine (including ovarian), (5) Testicular, (6) Renal.

It is, however, unnecessary to describe the clinical history of these disorders here, since they will be treated of under the headings of the morbid affections of the particular organs which they infest.

COMPLICATIONS.—This part of our subject is of the greatest interest, and the facts regarding it are, to a considerable extent, of recent discovery. If we turn to the excellent treatises of Valleix and Romberg, which appeared about a quarter of a century ago, we find a very inadequate importance assigned to the secondary affections which occur in Neuralgia. The convulsive movements of the facial muscles which occur in the severer forms of *tic douloureux* could not fail, of course, to attract attention even from the earlier times. Of the functions of special sense Valleix only mentioned *hearing* as liable to be affected. Injection of the conjunctiva he spoke of as if it were a rare phenomenon in trigeminal Neuralgia. He did not mention modifications of nutrition at all, except those of the hair; and of modifications of secretion he only enumerated lachrymation, mucous flux from the nostril, and salivation as occasional phenomena. Of disturbances of the stomach he took a more appreciative view; and he mentioned, as a remarkable fact, that he never knew facial neuralgia caused by gastric disturbance, but had frequently observed the latter affection to occur in the course of a neuralgic attack, and apparently as the consequence of it. He gives no pathological explanation of the connection between them.

It is to M. Notta[1] that we owe the first scientific treatment of this subject of the complications of Neuralgia. The importance of these secondary affections is particularly brought out by this author in his remarks on trigeminal Neuralgia, of which he analyzes 128 cases. As regards special senses, he states that the retina was completely, or almost completely, paralyzed in ten cases, and in nine others vision was interfered with; partly, probably, from impaired function of the retina, but partly, also, from dilatation of the pupil, or other functional derangement independent of the optic nerve. The sense of hearing was impaired in four cases. The sense of taste was perverted in one case, and abolished in another. As regards secretion: Lachrymation was observed in sixty-one cases, or nearly half the total number. Nasal secretion was repressed in one case; in ten others it was increased on the affected side. Unilateral sweating is spoken of more doubtfully, but is said to be probably present in a considerable number of cases. In eight instances there was decided unilateral *redness* of the face, and five times this was attended with noticeable *tumefaction.* In one case the uniliteral redness and tumefaction persisted, and were, in fact, accompanied by a general hypertrophy of the tissues. *Dilatation of the conjunctival vessels* was observed in thirty-four cases. Nutrition was affected as follows: In four cases there was unilateral hypertrophy of the tissues; in two, the hair was hypertrophied at the ends, and in several other cases it was observed to fall off or to turn gray. The tongue was greatly tumefied in one case. Muscular contractions, on the affected side, were noted in fifty-two cases; of these, in thirteen, the contractions were in the muscles of the lip and nostril; in ten, there was tremor of the eyelid; in a great number many muscles were simultaneously affected. *Permanent tonic spasm* (not due to photophobia) was observed in the eyelid in four cases; in the muscles of mastication, four times; in the muscles of the external ear, once. *Paralysis* affected the motor oculi, causing prolapse of the upper eyelid, in six cases; in half of these there was also outward squint. In two instances the facial muscles were paralyzed in a purely reflex manner. The pupil was dilated in three cases, and contracted in two others, without any impairment of light; in three others it was dilated, with considerable diminution of visual power. Finally, with regard to common sensibility—M. Notta reports three cases in which *anæsthesia* was observed. *Hyperæsthesia* of the surface only occurred in the later stages of the disease.

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[1] Archives Générales de Médecine, 1854.

Various other observers have added to this list of the secondary affections which may occur in facial Neuralgia the following: Iritis, glaucoma, corneal clouding, and even ulceration; periostitis, unilateral furring of the tongue, herpes unilateralis, &c.

All the above complications of fascial Neuralgia, excepting glaucoma, have been under my own observation, and most of them I have seen in a great many cases. Moreover, my own attention had been called independently to the subject by my own unlucky personal experience. I began, at the age of about fourteen, to suffer from attacks of unilateral facial Neuralgia in the right side (chiefly supra-orbital), which very soon assumed the type of severe migraine, such as it has already been described. A year or two later, the pains being at this time severe and frequent, there occurred a painful thickening and tumefaction of the periosteum round the brow, and also the formation of one or two dense white patches on the cornea, in the centre of which small phlyctenular ulcers appeared. About the same time, probably, there occurred a great thickening of the fibrous tissue, surrounding the upper end of the nasal duct, which caused a dense stricture of that canal. Some years later, when the attacks had become much less frequent, they recurred with great severity during the prostration brought on by choleraic diarrhœa. I then first noticed that the hair of the eyebrow was whitened opposite the supra-orbital notch, and that gray hairs were thickly strewn over the right side of the head for some time after the attack; and this phenomenon has occurred after every severe attack since that time. It only lasts in intensity for a few days, and the colour soon becomes partially restored to its original tint, but *without any falling off of the hair.* The latter fact seems at first difficult of belief; but I have most closely observed the phenomenon, and have since witnessed the same thing in several patients, both of my own and other practitioners. Another nutritive modification which I have seen in my own case is the formation of a dense epithelial fur on one half of the tongue.

There is another complication which, so far as I am aware, was first identified by myself as having a definite relation to facial Neuralgia: viz. erysipelatoid inflammation of the tissues to which the painful nerve is distributed. Some years ago I was much surprised at observing, in a women aged thirty-two, a patient of the Chelsea Dispensary, a most acute attack of unilateral erysipelas of the face and head, supervening on some severe and frequently recurring attacks of Neuralgia, which affected all three divisions of the trigeminus, but was most violent in the branches of the ophthalmic division. On the occurrence of the erysipelas, the acute pain subsided, but the most intense tenderness remained for some days, and pressure anywhere in the track of the nerves would re-excite a momentary spasm of pain. Since that time I have been constantly on the look-out for similar cases, and have observed a good many either in my own practice or that of others. In several instances I have seen Neuralgia of the fifth actually terminate in an affection undistinguishable from ordinary erysipelas, limited to the painful parts: in four of these cases it was limited to the side of the nose, the infra-orbital and frontal regions. But the facts bearing on a connection between facial neuralgia and erysipelas, are by no means limited to this. In twenty-two cases which have come under my care, of patients suffering either from typical facial tic, from migraine, or from *clavus hystericus*, I have discovered, by inquiry, the existence of a strong tendency to erysipelatoid inflammation of the parts then affected with Neuralgia. An attack of erysipelas would be brought about in these patients, by the most trivial causes, by a slight exposure to cold winds, or, on the other hand, by unusually depressing fatigue, or emotion. The majority of these patients gave me a family history which showed a marked inherited disposition to neurotic affections, a circumstance which, as we shall hereafter see, is of importance.

Perhaps the most striking of all the cases which have come under my notice is one which was obligingly sent to me by Mr. Ernest Hart, and which I have already published[1] in detail. The exciting cause of the whole train of phenomena was apparently fright, from an accident which there was no reason to suppose inflicted any direct physical injury. The sequence of events was: (1) abrupt cessation of menses, with hysteric depression; (2) severe neuralgia of the first and second divisions of the fifth, quickly producing iritis, with effusion of lymph; (3) erysipelas, exactly limited to the skin of the painful parts, and as it were supplanting the Neuralgia.

The concurrence of *iritis* with the erysipelas, in this case, is a most interesting fact, as showing a general tendency to paralysis of the vessels in the affected district, which will be much dwelt on in the section on pathology. The connection of iritis with Neuralgia is a subject which, although only quite recently mooted, already assumes an extraordinary magnitude, and may yet lead to pathological and therapeutical discoveries of first-rate importance. For my own part I do not hesitate to express the belief that the very vague and ill-defined disease known, in common phrase, as "Rheumatic iritis," is destined to be almost, if not quite, banished to limbo; for that careful observation will prove the cases so denominated to be nearly all capable of classification as "Neuralgic iritis."

The symptoms which characterize this malady are as follows: The patient first of all complains (usually after exposure to cold wind, or damp, or both) of pain round the orbit, which gradually increases to a pitch of great severity, but which exhibits marked intermissions or at least remissions. The vessels of the conjunctiva, but more particularly of the sclerotic, then become injected. Last of all the iris itself becomes cloudy, and, in severe cases, actual deposits of lymph take place. I cannot hesitate to say, from careful inquiries into the past history of such patients, that this kind of affection occurs quite as frequently in persons who have never shown any distinctive rheumatic tendencies as in those who have. On the other hand there is nearly always a recognizable history of tendencies towards neuralgic affections of one sort or another. And indeed, with regard to the whole series of so-called chronic rheumatic affections of fibrous membranes, it must be remembered that there is reason to doubt whether, on careful analysis, their local symptoms can be grouped into any intelligible unity. It seems far more likely that, as the consequences of spinal irritation become more perfectly known, the whole group of such affections will be resolved into particular cases of centric nervous irritation.

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[1] Lancet, 1866, vol. ii. p. 548.

And finally, it may be noted that this variety of iritis is greatly more amenable to the influence of quinine than to that of any other remedy; in fact, beyond the use of belladonna to prevent pupillary adhesion, no other treatment is required.

Herpes, as a complication of dorso-intercostal Neuralgia, has been already referred to. Although not so commonly, it may probably attend Neuralgia of any superficial nerve. Fòr instance, the occurrence of a regular facial herpes zoster has been considered by many authors not so much a rarity as an impossibility. But various single cases have been recorded by individual observers of late years, and in a very valuable paper on unilateral herpes in the London Hospital Reports for 1866, Mr. Jonathan Hutchinson reckons up fourteen cases, including several which came under his own observation; some of them are mentioned to have been accompanied by Neuralgia of the fifth. In one of these cases, in which the Neuralgia was particularly severe, the herpetic vesicles were followed by ulcers, which left considerable scars on the forehead. I have myself seen herpes the attendant of two cases of cervico-brachial Neuralgia, in one of which the ulcerations following the vesicles were a cause of severe suffering; and in one instance of sciatica in my practice there occurred enormous vesicles, or rather bullæ, on the back of the calf, which formed most troublesome and exquisitely painful ulcers. Barensprung[1] records a similar case, in which the irritation of the sciatic was secondary to psoas abscess.

The tendency of deeper tissues to be affected in an inflammatory manner as a consequence of Neuralgia, which is especially shown in the cases of neuralgic iritis, receives every-day illustration. In fact, the painful points so universally observed in severe or inveterate cases are probably produced by a subacute inflammation, first of the fibrous membranes (periosteum or fascia) in contact with the nerve at points where it comes out from a deeper to a more superficial position, and further (in some cases) to all the subcutaneous tissues for an inch or two round. In one of the cases of cervico-brachial Neuralgia already referred to, a bright red painful spot, as large as half-a-crown, appeared on the outer side of the arm; there was dense thickening of tissues in this situation, and the resemblance to an inflamed syphilitic node was remarkable. The neuralgic origin was, however, unmistakable. Among the cases of facial herpes collected by Hutchinson, there are several in which serious, or even irremediable damage was inflicted on the eye by general inflammation of its tissues.

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[1] Loc. cit.

DIAGNOSIS.—The diagnosis of neuralgic affections from others which may involve pain is, on the whole, not difficult, if we are able to extract from the patient a full account of his history. The essential points for observation are: 1. The situation and direction of the pain, whether this is unilateral, whether it corresponds to the course of a recognizable nerve branch or branches. 2. Whether it is intermittent, or markedly remittent. The points of history which are most important are: 1. Whether the patient has suffered Neuralgia before, and if not, whether neuralgias, or neurotic disease of any kind have prevailed in his family. 2. Whether the attack was preceded by nervous depression, or was ushered in by distinct numbness or tingling. 3. Whether the immediate excitant appeared to be cold or damp, or both, or a severe nervous shock, or a direct physical injury. 4. (If the affection has lasted some time) whether there has occurred any development of secondary tender points in the situations where, as above described, they might be expected. 5. Whether the patient has suffered from secondary affections of glands (*e. g.*, lachrymation, in the case of facial pain) during the attacks, or of temporary congestion of surfaces (*e. g.*, of the conjunctiva) in the same case, or from alterations of epithelium or hair, or herpetic eruptions, or erysipelatoid inflammation of the skin corresponding to the distribution of the affected nerves.

The affirmative answer to any of these questions is, *pro tanto*, in favor of the genuinely neuralgic character of the disorder; and, indeed, the union of features 1 and 2, under the heading of "observation," with one, or still more with two or three, of the "historical" facts, would be pretty well decisive in this sense.

The main source of embarrassment, in difficult cases of diagnosis, is the impossibility which we sometimes encounter of getting a clear history. This is especially apt to occur when we are called to the patient not so much on account of the primary neuralgic affection as because of severe secondary consequences that happen to have arisen. For instance, in a case of severe Neuralgia of the fifth, attended with periosteal inflammation round the orbit, or with intense conjunctivitis, and, it may be, corneitis, or even iritis, the history related is likely enough to lack explicit details of the primary affection. It is necessary to inquire very strictly whether the pain, when it first occurred, was, or was not, accompanied by tenderness on pressure; and whether this simple pain markedly preceded the organic lesions.

Another serious difficulty arises, not unfrequently, in distinguishing between true Neuralgia, and that form of pain which is vaguely called hysteric; and also between the former, and Myalgia not associated with the hysteric diathesis. The great characteristic of true Neuralgia is the limitation of the pain to the course of recognizable branches of nerves, as opposed to the diffused character both of hysteric and neuralgic pains. A history of intense hysteric predisposition may help the diagnosis in some cases, and a history of overwork done by under-nourished muscles may clear it up in others. But hysterical persons may, and sometimes do, suffer from true Neuralgia. And again, it is very common for hysteric patients to develop tender points in certain situations (especially beneath the left mamma, in the epigastrium, and at various situations along the vertebral fossæ which lodge the great muscles of the back), which bear a superficial similarity to the tender points developed in long-standing Neuralgia. The more generalized hyperæsthesia of the skin which usually accompanies these symptoms, when they are due to hysteria, will seldom, be observed, however, in true Neuralgia; and the remarkable affections of volition which mostly accompany the hysteric diathesis rarely occur in Neuralgia pure and simple. A means of diagnosis between hysteric hyperæsthesia and the true Neuralgia which I have found most useful is the use of Faradisation. It has a strikingly inactive effect in the former, but acts much more slowly, or not at all, in true Neuralgia.

It is almost impossible to lay down rules of diagnosis, in this place, between neuralgia pure and simple, and that which accidentally occurs from a nerve becoming squeezed, or otherwise damaged, in the progress of tumours or other organic diseases external to it. The reader must be referred to the diagnostic characters mentioned in the treatises on such diseases for the means of distinction.

The neuralgic pains which usher in locomotor ataxy, are highly peculiar, and their diagnosis from ordinary Neuralgia must be learned by studying the article on the former disease.

PROGNOSIS.—The prognosis of Neuralgia is nearly always an uncertain matter. The simplest case is when a clearly malarial history can be made out, and when the blood infection has not lasted too long: here we may expect a speedy cure by appropriate treatment. The least complicated varieties of traumatic Neuralgia—those in which the irritation is only kept up by some mechanical irritation (*e.g.*, a foreign body lodged, or a tight cicatrix making pressure)—of course offer a good chance of cure by surgical interference. Among the Neuralgias which are more purely of internal origin, those are chiefly to be regarded as benign which occur in young subjects; and next to youth in favourable influence on the prognosis comes the fact of otherwise unbroken health. Neuralgia becomes progressively less curable in each successive decade of life, and more especially after the commencement (at whatever nominal age) of the symptoms of organic degeneration. Very formidable, in all cases, is the fact that the patient's family have been liable either to severe Neuralgias, or to other grave neuroses. And when a patient with such a family history is first attacked with a Neuralgia after he has already entered on the period of organic degeneration, his chances of complete recovery must be reckoned very small. Moreover, such a Neuralgia is not unfrequently the first warning of a degeneration of the centres, which will end with softening of the brain.

These are the fundamental points in prognosis. A less essential, but still important, class of momenta are the circumstances of the patient's life; how far, for instance, he is likely to be exposed to the hostile influences of cold, damp, and privation, with the disorders which they tend to engender; and how far there may be unavoidable exposure to the influences of mental distress, or of the weariness of an objectless life.

PATHOLOGY AND ETIOLOGY.—These two subjects, in the case of Neuralgia, are inextricably mixed; nor is it possible to discuss the one without constant reference to the other. They are so mixed, firstly, because there is no sufficient basis of anatomical fact to support a "pathology," in the ordinary sense; and secondly, because, in addition to the philosophical difficulties which always beset the construction of an etiological system, there are, in the case of Neuralgia, special obstacles to the decision as to what is "cause" and what "effect" arising from the necessity of regarding a neuralgic person as a mere offshoot of a certain family beset with peculiar tendencies, rather than as an individual who forms his own physical destiny by the manner and circumstances of his life.

Of facts tending to elucidate the morbid anatomy of Neuralgia there are very few. This necessarily follows from the rarity with which neuralgic patients die under circumstances which lead to any careful examination of the nerves and nerve centres. Among the very few recorded cases which show anything positive is the remarkable one related by Romberg.[1] The patient was a victim to the severest form of facial Neuralgia, "of the period of bodily degeneration" such as I have described it. The Gasserian ganglion of the painful nerve was almost destroyed by the pressure of an internal carotoid aneurism, the trunk and posterior root of the nerve were completely degenerated, and the atrophic process had extended, in less degree, to the nerve of the opposite side.

This case, alone, of course, *proves* nothing as to the general question of the pathology of Neuralgia. But it teaches a notable fact, that the extremity of pain can be suffered in a nerve in which sensation would soon have become extinct by dissolution of the connection between centre and periphery. It is imaginable that a not less real, but less advanced and less coarsely obvious atrophic change may have been present in every case of Neuralgia, even where dissection has failed to reveal anything amiss. It must be remembered that the microscopic study of morbid changes in nerve tissues is even now only in its infancy. It would be vain to occupy a large space, in a practical treatise, with disquisitions on a subject at present so obscure as the pathology of Neuralgia; I shall therefore content myself with stating the hypothesis which appears most probable to me, and the mere outline of the reasons which incline me to adopt it.

I think it most probable that in *all* cases of Neuralgia there is either atrophy, or a tendency to it, in the posterior or sensory root of the painful nerve, or in the central gray matter with which it comes in closest connection. The following are the heads of the argument:—

1. Neuralgia is eminently hereditary. It is constantly observed to prevail in particular families, breaking out in successive generations

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[1] Diseases of Nervous System, Syd. Soc. Trans., vol. i.

and various individuals. But what is even more important to notice is the fact that these neuralgic families are almost invariably also distinguished by a tendency to the severer neuroses—insanity, cerebral softening, paralysis, epilepsy, hypochondriasis, or an uncontrollable tendency to alcoholic excess; and very often in the various members of the same family we may observe the alternation of all these affections, and of Neuralgia, in various members.

2. Such hereditary tendencies in a race seem strongly to suggest a tendency to imperfection in the congenital construction of the central nervous system; so that we may imagine that certain cells and fibres of this system are, in a large proportion of that race, built, as it were, only to live with perfect life for a short term. The weak spot may be in one place in this person, in another place in that.

3. Given such a weak spot congenitally present, all hostile influences will tell more heavily on it than on the rest of the organs. The depressing influence of cold applied to the periphery, of a wound of the trunk or branches of a nerve, of a severe shock (mental or physical) to the nervous centres generally, or of continued alcoholic excesses, will suffice to throw the imperfectly constructed cells into a state of positive disease, which may end in decided atrophy. Even in the absence of any special external cause, the depressing influence on the nervous centres produced by the great crises of puberty, child-bearing, the involution of the female organs at the grand climacteric, and still more the partial failure of nutrition which the arterial degeneration of advanced life would cause—any of these may suffice to start the local morbid process.

4. A very weighty argument in favour of the idea that central mischief is a factor in all cases of Neuralgia is the great frequency of complications, such as have been described, in which various nerve-fibres, quite distinct from those which are the seat of pain, and connected with these only through the centre, are secondarily affected.

5. Those cases in which a localized peripheral lesion is the immediate excitant also require for their explanation the assumption of a peculiarity in the individual, as one factor, and that the most important, in the production of the Neuralgia. For of hundreds of persons to whom exactly similar lesions happen every year, not more than two or three, perhaps, experience any Neuralgia; and these two or three will, I believe, be invariably found to belong to neurotic families.

6. The only cases to which the theory of congenital central imperfection appears neither applicable nor necessary are those in which a pressure, ulceration, or other lesion extending from neighbouring tissues towards the nerve, maintains a constant depressing centripetal influence which it is not difficult to suppose might impair the vitality of the posterior root, or of the central gray matter.

7. Certain influences, especially that of excessive drinking, which notoriously tend to produce degeneration of the nervous centres, are powerful predisposers to the production of Neuralgia of the inveterate

8. Moreover, the descendants of drunkards, among other evidences n enfeebled nervous organization, are decidedly prone to Neuralgia.

So frequently have I made the discovery that neuralgic patients have had drunken parents, that I cannot suppose the coincidence to be accidental.

TREATMENT.—The treatment of Neuralgia may be classified under three heads. The first division includes all remedial measures which are intended to improve the general nutrition, including that of the nervous system, or to remove any vicious condition of the blood which may impair nervous function. The second division includes the narcotic stimulant remedies. The third division comprises all the remedies which are destined to exert a direct influence upon the affected nerve.

1. Constitutional treatment.

(*a.*) Under the head of *nutritive* remedies for Neuralgia, by far the most important sub-class is the series of animal fats. There is a theoretical basis for the use of these substances which it is impossible to ignore, although I have no desire, in the present state of our knowledge, to insist too absolutely upon it. In some way or other, fat must undoubtedly be applied to the nutrition of the nervous system, if this is to be maintained in its organic integrity; since fat is one of the most important, if not the most important, of its organic ingredients. But if our theoretical ideas on this point be as yet deficient in the exactness which is to be desired, there can be no doubt, I think, that the practical lessons which they would teach are abundantly verified in experience. If we take, for instance, the class of Neuralgias which are most plainly and indubitably connected with impaired nutrition—those of advanced life, and particularly the inveterate forms of facial tic douloureux—there is the strongest ground, in the result of experience, for insisting upon the value of this class of remedies. To Dr. Radcliffe belongs the merit of having been chiefly instrumental in bringing forward this therapeutical fact in this country, and it is one which I have had repeated occasions to verify. It is a very singular circumstance, which also was first pointed out by Dr. Radcliffe, that neuralgic patients are, in the majority of instances, found to have cherished a dislike to fatty food of all kinds, and to have systematically neglected its use. I have also obtained strong evidence that this is the general rule, and the reverse a rare exception. And it has several times occurred to me to see patients entirely lose neuralgic pains, which had troubled them for a considerable time, after the adoption of a simple alteration in their diet, by which the proportion of fatty ingredients in it was considerably increased.

Cod-liver oil occupies the highest rank among fatty remedies; where it does not immediately disagree with the stomach, this oil is the best fat to employ. But in other cases butter, and especially cream, may be employed with great advantage; and in fact one of the most successful examples of the treatment of Neuralgia which I record was treated solely by the administration of Devonshire cream in increasing, and finally in very large quantities. Even the vegetable olive oil, though far inferior to animal fats as a general rule, may occasionally be used with good effect. It is necessary in many cases to make a series of trials, before we arrive at the particular form of fatty food which is best suited to the particular patient.

(*b*) The various preparations of iron are of use, so far as I know, only in cases which are marked by the existence of actual anæmia. For patients who possess well globulated blood (as indicated not merely by the colour of the face, but by that of the mouth and tongue, especially by the freedom of the latter from teeth-markings, and by the absence of the drowsiness, *muscæ volitantes*, &c., which indicate defective blood-nutrition of the brain) I do not believe that iron treatment has any value. The carbonate, in large doses, is the best form, when iron is needed at all.

(*c*) The employment of the so-called special nerve-tonics is of great use in some cases, of none at all in others. Quinine, arsenic, and zinc (in various preparations) are the only medicinal substances of this class which possess any solid claims to efficacy.

With regard to the efficacy of quinine there are the most conflicting opinions, except in one respect. No one doubts that in the Neuralgias which are of malarious origin this medicine, though not infallible, is extremely efficacious. It should be administered, in all cases which from their regular intermittence leave room for a suspicion that this may be their nature, in full doses (five to twenty grains) shortly before the time at which the attack of pain is expected; in fact just in the way which proves most effective in the treatment of regular ague. If after three or four doses a decided improvement is not effected, the probability is great that the Neuralgia is not malarial. Nevertheless, arsenic may subsequently be tried if other means (to be presently described) prove ineffectual.

In a certain number of non-malarial cases, also, quinine produces good effects; but there is no need, nor is it advisable, to employ it in such large doses. From two to three grains, three times a day, is the largest quantity which is likely to be of any use, if my own experience is worth anything. I know of no circumstances which indicate beforehand that quinine will be useful in non-malarial cases, *except that it seems always much more effective in Neuralgia of the ophthalmic branches of the fifth, than in other non-malarial Neuralgias.*

With regard to other non-malarial Neuralgias I share Valleix's opinion, that it is far from being frequently useful.

Arsenic is a more widely applicable remedy; for it is useful in many cases both of the malarial and of the non-malarial type. In the former, it should be given, probably, in full doses, ten minims, increasing to thirty, of Fowler's solution, three times a day. In the non-malarial forms, the ordinary tonic dose of five minims of Liq. Arsenicalis, three times a day, or $\frac{1}{16}$ grain of Arseniate of soda in pill, with extract of hop,[1] will effect all the good which this medicine can produce. The ordinary precautions must of course be observed, as in any other case where we employ arsenic. There is one form of Neuralgia, however, which merits special mention in relation to arsenical treatment; I mean the specially neurotic form of angina pectoris. In France this remedy is extensively used for cardiac Neuralgia. I have myself seen most remarkable relief afforded by arsenic in this complaint, and an extraordinary tolerance of the system to large doses of it. Very recently Dr. Philipp has put on record a most interesting case of the kind.[1] There are, indeed, some patients whose alimentary canal is too irritable to bear this remedy at all; but it is usually well borne, and often extremely efficacious. Arsenic may also be effectively administered by subcutaneous injection.

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[1] Dr. Radcliffe tells me he finds that extract of hop enables arsenic to be better tolerated than when given alone.

The preparations of *zinc*, and more especially the valerianate, enjoy a high reputation with some practitioners. It is necessary to record this fact; but I cannot say that I have ever seen any good result, which could be confidently attributed to these remedies, in Neuralgia.

(*d*) Last, among the constitutional remedies, we have to mention those which are directed against a real or presumed depravation of the blood by some special poison. Neuralgia may certainly arise from *syphilis;* but then it is probably always due to a local deposit somewhere in the course of the affected nerve. Where this can be suspected iodide of potassium should be administered in large doses; and if this fails, the bichloride, or biniodide of mercury, in small doses. Neuralgia is said to have frequently a *gouty* origin: but the facts on which this statement rests, perhaps hardly warrant a decided opinion. They scarcely amount to more than this, that in a certain ill-defined group of cases, the subjects of which are perhaps more often than not of a gouty constitution, a form of Neuralgia occurs which yields more speedily to treatment with colchicum than to any other remedy. Twenty to thirty minims of the tincture or the wine, three times a day, will be sufficient; and if a marked good effect be not produced in two or three days, the medicine should be abandoned, or even earlier, if any tendency to weakness or irregularity of the heart's action be perceived.

"Rheumatic" Neuralgia is a phrase which, under the precautions above indicated, must still be retained, as signifying a class of cases in which inflammation of circumjacent fibrous tissues seems to cause the neuralgic pain by producing mechanical damage to the nerve. Iodide of potassium in five to ten grain doses twice or thrice daily is often useful; causing the absorption of local deposits, or rather of local proliferations of fibrous tissue. Even in cases where the Neuralgia was the primary affection, and the fibrous hypertrophy secondary to it, the local tenderness and swelling appear to be often diminished by the use of this remedy. I have never seen *colchicum* produce the slightest benefit in these cases, in which local tenderness is a prominent symptom.

2. We have now to consider the large group of narcotic stimulant remedies for Neuralgia. In this class, I include not only the substances generally recognized as belonging to it, such as opium, belladonna, alcohol, &c. &c., but also many others, such as ammonia, tur-

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[1] Berlin. Klin. Wochensch. 4, 1865.

pentine, &c., which are commonly spoken of merely as "stimulants;" and also substances which, like aconite, are ordinarily ranked either as pure "sedatives" or as "acro-narcotics." I shall not retrace here the arguments which I have given at large, in my work on "Stimulants and Narcotics,"[1] to prove that all these substances possess the common property of assisting nerve function when given in small doses, and of paralyzing it when given in excess.

The narcotic-stimulant group of remedies, when administered internally or by subcutaneous injection, may be said to hold an intermediate position between the constitutional and the local agencies which we may employ against Neuralgia. On the one hand, they enter the general circulation, and pervade the organism. On the other hand, it may be suspected that in many cases their effect is produced mainly by a local action, either upon the central nuclei of affected nerves, or perhaps upon their spinal ganglia.

Indisputably, at the head of all this class of remedies stands opium. And we may consider opium, as used against Neuralgia, to be fully represented, for every useful purpose, by morphia. But the gastric administration of opiates can, after all, be only considered as *palliative.* The invention of the subcutaneous injection (which was imperfectly forestalled by the *endermic* method), has thrown quite a new light on the capabilities of opium as an anti-neuralgic. It may be confidently said that in the right use of this remedy, we possess the means of permanently and rapidly *curing* very many cases, and of alleviating, to a degree quite unknown before, the suffering caused by even the most inveterate forms of Neuralgia.

The *local* injection of alkaloids, as first systematically employed by Dr. Alexander Wood, is a proceeding which is specially applicable, in my opinion, only to a few cases. In many instances the nature of the integument at or near the point of severest pain, is such as to render the local operation inconvenient or even impossible. In the great majority of cases, especially those which are seen early, the injection may be more advantageously performed in some indifferent place, such as the loose skin over the front of the biceps muscle, or, in fact, in any place where a fold of skin can be conveniently picked up. The substance injected, if properly dissolved in a convenient quantity of fluid, quickly enters the general circulation, and, in a large majority of instances, produces just as decided an effect on the local nerve pain, as if it had been locally injected. I cannot doubt that, in the greater number of cases, the "local" injection is such only in name; the injected substance producing no effect till it has entered the absorbent vessels of the veins, and thence travelled all round the circulation to the small arteries, either of the spinal and ganglionic centres, or, perhaps, to the arteries which supply the peripheral branches of nerves. The discovery of the great utility of the plan of general, as opposed to local injection, is due to Mr. Charles Hunter, and is of the highest importance, not merely as a practical fact, but in the suggestions which it gives as to the general subject of the place of origin of Neuralgia. There is, however, a class of cases in which the local injection of morphia becomes desirable. In advanced cases, in which very great local hyperæsthesia exists, and there is reason to think that thickening and hypertrophy of the structures round the nerve have taken place, I have several times known injection at a distant point to fail, when local injection of the same substance, in the same dose, has immediately produced a marked effect; and the same thing has recently been pointed out to me by several medical men. It happens sometimes, however, that in the very cases which seem most to demand the local injection, the local tenderness makes the operation intolerably painful: in such a case I should recommend a plan which Mr. Hart introduced to my notice, viz: that of first rendering the skin insensible with ether spray, and then injecting. As the freezing process renders the tissues quite hard, a *steel* canula to the syringe is needed to penetrate them.

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[1] London: Macmillan. 1864.

As regards the dose to be employed, I cannot but think that the received ideas are much in fault. One hears constantly of as much as half a grain or one grain, even, of morphia being employed, even at the outset. That such quantities are necessary, sometimes, where the cellular tissue injected into is already irritated and thickened, I have no doubt; and I explain it by the hypothesis that a good deal of the injected substance never enters the general circulation, nor even the vessels of the part, but lies encysted, just as is undoubtedly the case when one injects an irritant substance like pure chloroform into the cellular tissue anywhere. But I am quite certain that when injection of any non-irritant solution of morphia into a healthy cellular tissue is *neatly performed*, it is unnecessary and *even unsafe* to commence with larger quantities than $\frac{1}{6}$ gr. Both in my own practice and in that of a friend, I have known so little as $\frac{1}{4}$ gr. produce dangerous symptoms of poisoning in a person not especially sensitive to opium; and I am convinced that the activity of remedies hypodermically used is generally much underrated. I have produced all the desired effects by injection of not more than $\frac{1}{10}$ gr. in slight cases, and very rarely indeed (where the morphia is injected at an indifferent spot) do I increase the dose beyond $\frac{1}{2}$ gr. The best medium dose is $\frac{1}{6}$ gr. and the injections should be repeated, if possible, daily, or even twice a day in severe cases. In visceral Neuralgia, it need hardly be said, we are obliged to be contented with injection at an indifferent spot; yet (as, *e.g.*, in ovarian neuralgia) we sometimes produce excellent effects.

Next to opium in value, amongst the stimulant narcotics, is *belladonna* and its alkaloid *atropia*. The value of belladonna, as given by the stomach, is confined pretty much, according to my experience, to painful affections of the pelvic organs, on the sensory (as notoriously in the motor) nerves, of which it seems to have a special influence. In doses of $\frac{1}{6}$ gr. to $\frac{1}{2}$ gr. of the extract, it will frequently relieve ovarian dysmenorrhœa, as also some forms of superficial lumbo-abdominal Neuralgia. But by far the most important use of belladonna is by the subcutaneous injection of atropia. From the $\frac{1}{120}$ up to the $\frac{1}{30}$ of a grain is about the range of doses for adults; and I can confirm the statements of Mr. Hunter that by repeated applications of this treatment, even very severe and inveterate Neuralgias are often greatly relieved, and sometimes cured. It is a question whether there is not less tendency to relapse after this treatment than after that by morphia. On the other hand, I have met with more than one person in whom it has been found impossible to give a dose sufficient to relieve the pain without producing distressing head symptoms.

Next in value to morphia and atropia comes Indian hemp, which has been especially brought forward by Dr. Reynolds. A *good* extract of this, in doses of from $\frac{1}{4}$ to $\frac{1}{2}$ grain or (rarely) 1 grain, given in pill, is very effective in some forms of Neuralgia, particularly in clavus hystericus and migraine. Even in the severest and most intractable forms it often palliates greatly. It should be given every night, whether there be then pain or not.

Muriate of ammonia is an excellent stimulant remedy in migraine and clavus, and in some cases of intercostal neuralgia. It should be given in 10 to 20 gr. doses. In cases of suspected hepatic neuralgia I have also found it very useful; and I believe that its action on the liver (in disorders of secretion) is through the nervous system entirely.

Sulphuric ether, which in the severer forms of superficial neuralgias is of little or no effect, is supremely useful in certain visceral neuralgias. It sometimes relieves gastralgia, and Neuralgia of uterine or ovarian origin, with magical rapidity. But it is still more valuable in the most purely nervous form of angina pectoris. I have now under my care a case of this latter affection, which I am convinced would have ended fatally long since, in one of the agonizing attacks of spasmodic heart-pain, but for the discovery that by taking a spoonful of ether immediately on its commencement, the patient can greatly mitigate the attack. This patient had tried arsenic, but from the irritability of his intestinal canal, could not take it. The same dose of ether has continued to produce the same happy effect on each occasion of its use for the last three years.

Aconite, in the form of Fleming's tincture, is of very great use in some forms of Neuralgia, especially in that kind of ocular neuralgia, with secondary inflammation, which is so frequently called rheumatic iritis. But, unfortunately, it is a very uncertain remedy in one respect; with some persons it produces nausea, burning in the throat, and a sense of cardiac depression, with doses which are quite harmless to other patients. In a case where I recently employed it, in only three minim doses every six hours, I was compelled to abandon it after the third dose, from the intensely depressing effect which it produced.

The oil of turpentine is a remedy which enjoys, or enjoyed, considerable reputation for its effect in a certain class of cases. In the more obstinate forms of sciatica it is at least worth a trial, although it is commonly very disagreeable to the patient; ten minims, three times daily, is the proper dose.

Still, after the enumeration of all the narcotic stimulant substances which have been, and many more that might be named, it would be idle to pretend that any of them are to be compared, for wide and general efficacy, to the subcutaneous use of morphia and atropine, and the internal use of Indian hemp in small doses.

I have reserved to the last, under the head of Stimulant Narcotics, what must be said about alcoholic drinks. There can be no question about the power of alcohol to relieve neuralgic pains; it is as distinct as that of opium. But the dangers of prescribing it as a remedy are very great, since the patients cannot always be induced to use it in the strictly medical manner in which alone it is safe. Too often, instead of employing it in the moderate stimulant doses which really are of service, they accustom themselves to drowning the pain with a large narcotic dose, and they thus contract a liking for the oblivion of drunkenness. It is of much consequence, where this is possible, that they should be forbidden to take alcohol otherwise than at meal times. If once they are induced to take it for the mere relief of acute pain, there is great danger that they will drink to excess. I am, nevertheless, convinced that a fixed daily allowance of wine or brandy (beer more rarely agrees), which shall contain not more than one ounce of absolute alcohol, is a decided help to recovery from every form of Neuralgia; and in the case of persons of firm character, who can be trusted to exercise self-control, a larger quantity than this may sometimes be allowed. Without pretending to speculate on the physiological reason for it, I must add my testimony to the fact, which has been observed by Dr. Radcliffe, that *saccharine* liquors and saccharine foods, except in very moderate quantities, decidedly disagree with neuralgic patients.

3. We come now to consider the external remedies for Neuralgia. Incomparably the most valuable of these is the use of so-called counter-irritation; that is, the application of various irritants to the skin. Valleix comes to the conclusion that there is no one remedy which approaches *blistering* in value, and (putting aside the recently discovered hypodermic treatment) that saying remains absolutely true at the present day. It is to be observed that Valleix latterly always employed the milder form of the flying blister. Such an application as this to the foci of pain must, if we consider it, be supposed to excite a directly stimulant effect upon the painful nerve. This kind of blistering, and the analogous use of mustard plasters, have always yielded good results, in my experience, solacing even when they did not cure. And in numerous early cases one or two flying blisters, applied successively over different points in the course of the painful nerve, have at once and permanently arrested the disease. It is a remedy which ought always to be tried in cases of any severity, especially if the subcutaneous injection of morphia and of atropine has failed. There is one method of blistering which I have recently tried with great success, viz., the application of a blister close to the spine, as nearly as possible opposite the intervertebral foramen from which the affected nerve issues. The effect produced is, I suppose, a reflex stimulation through the posterior branches. This method is of course not so applicable to Neuralgias of the fifth as to those of spinal nerves.

Yet even in these, blistering of the nape has sometimes appeared to do marked good—through the occipital nerve, I presume.

The application of various stimulating liniments and ointments to the skin of the painful parts is sometimes very useful. Of these the use of chloroform diluted with seven parts of oil or soap liniment is far the most efficacious. This produces no anæsthesia, but a mild stimulation. Strong *counter-irritation* may be produced by the use of tartar-emetic or of veratrine ointment.

Electricity.—The efficacy of various forms of electricity in Neuralgia is a large subject, and as yet, it must be owned, only very partially cleared up. The comparative merits of Faradisation and of the continuous current are hardly settled. But the weight of testimony is now in favour of the belief that in the majority of instances the continuous current is the most valuable.

As regards one or two points, one may speak with some confidence. In the first place I may say, after extensive trials of the ordinary rotatory (magneto-electric) machine for the *induced* current that this method of treatment is most unsatisfactory. I have never seen it produce, indisputably, good effects. Secondly, as regards that form of *continuous* current which is generated by Pulvermacher's chains, I am reluctantly obliged to give up the hope of doing any real service with it in Neuralgia, however great its utility is in other diseases. As is remarked by Dr. Althaus, the current generated by these chains is too irregular, and their activity is too soon exhausted for us to get a sufficiently uniform dose of electricity applied continuously for a definite period by their means.

It appears probable that we shall ultimately find that for neuralgic affections of all kinds the most useful form of electrical treatment is by the continuous current generated from a Bunsen's or a Daniell's battery; and that the three principles on which we must act in its use, are: 1. The maintenance of the current, with only a very few breaks, for a considerable time. 2. The application of the positive pole over the seat of pain. 3. The employment of a very low-tension current. I am informed by Mr. J. N. Radcliffe, whose experience in this matter is very large, that the use of this mode of electrization in Neuralgia is as yet, in his opinion, only beginning to be developed, but that it promises to effect great things. In short, my present opinion as to the value of electricity in Neuralgia may be thus expressed: that as used, up to the present time, it has achieved no results which entitle it to more than a third or a fourth-rate place among remedies; but that if the desideratum of a low-tension continuous current, which can be readily applied for long periods together, can be obtained by means of apparatus of moderate portability and cheapness, it is probable that we may obtain that which will equal or exceed in value any of the remedial measures which are at our disposal.

A few words must be given to the rather uninviting subject of the surgical treatment of inveterate Neuralgia. The section of a neuralgic nerve, or rather the excision of a piece, is still, I suppose, to be reckoned among the measures which it may be occasionally justifiable to employ. Nothing, however, either in the two cases of its use which I have seen, or in the records of similar operations, would lead me to recommend it in any case. The relief given is nearly always very transient: and, indeed, the nearly infallible certainty with which the pain returns in the central end of the divided nerve is only what I should expect from the many considerations which point to the central origin of the nerve as the most peccant part. With such remedies in our hands as the subcutaneous injection of morphia, &c. I cannot see that we need be tempted to perform such an operation for the sake of a temporary alleviation.

The removal of any distinct source of peripheral irritation by surgical means is quite another matter, and may be highly proper and necessary. Yet even here it is always necessary to calculate whether the shock of the procedure itself may not be injurious; and it will be desirable before inflicting it to fortify the system, as far as possible, with tonics; and sometimes to diminish the shock, not merely by giving chloroform, but by prolonging the chloroform narcosis by subcutaneous injection of a large dose of morphia. This precaution is especially advisable where we extract one or more carious teeth, which may seem to be keeping up neuralgic pain. Too often we find that the extraction has been in vain; and then, unless some such precautions have been taken, it may be discovered that the shock has aggravated the Neuralgia.

A most important subject with which I may conclude these remarks on treatment, is the employment of suitable *prophylactic* measures. First, as regards nutrition; it is absolutely necessary that this should be as abundant as may be possible without deranging the digestion. It must also contain a liberal allowance of fatty matters; no amount of dislike on the patient's part—and they often show great dislike—should induce the physician to give up this point. If one form of fat cannot be tolerated another must be tried; perseverance will, I believe, always bring success; and the effect of an improvement of this kind in the diet will rarely fail to tell upon the constitution, rendering the nervous system less sensitive to the ordinary exciting causes of neuralgic pain. Equally important is the avoidance of exposure to cold and damp air with insufficient clothing, for cold is much the most frequent immediately determining cause of neuralgic attacks. Flannel under-clothing, thick veils for the face, &c., are quite as important as any direct remedies. It cannot be doubted that everything which tends to set up the habit of pain, directly tends also to aggravate that obscure vice of the organism on which the disposition of Neuralgia depends, and *vice versâ*. Physical exercise must be so regulated that it may improve nutrition without inflicting severe fatigue. And as regards mental influences, which, unfortunately, are often beyond control, one can only say that the two extremes, of a specially laborious and exciting life, and an existence spent in the dreary monotony of idleness, are equally hurtful.

In the foregoing article I have followed the plan also adopted in my article on Alcoholism; namely, of stating my own view of the subject connectedly, and without pausing to answer all the statements and opinions of the numerous writers who differ from me. The necessary limits of a work like this "System of Medicine," makes it almost impracticable for an author to follow any other course with success, if he happens to hold a view of his subject which conflicts with, or differs from, the view of well-known authors on a considerable number of points. But the following selected list of the more important treatises will enable the reader to study the questions connected with this disease from every point of view. It has been my purpose to bring out clearly and consistently that view of Neuralgia which seems warranted by the majority of the facts recorded by others or observed by myself; and the result has been that I have given much prominence to the arguments for the existence of an element of organic change in the *centres* in all true Neuralgias. Those who desire, however, to hear all the arguments which can be urged for a chiefly or solely peripheral origin of Neuralgia will find abundant material in the undermentioned treatises: Trousseau, "Névralgie Epileptiforme," vol. i. of his "Clinique Médicale," 2me Edit.; "Névralgies," vol. ii. of the same work. (Trousseau's insistance on the constant presence of a painful "point apophysaire," seems to me an overstatement; but it is still more strange that this author should think its constant presence could consist with peripheral origin of Neuralgia.) Beau, Traité des Névralgies, Arch. de Méd. 1847. Brown-Séquard, Lectures on the Therapeutics of Nervous Diseases, Lancet, 1866, vol. i. See also his Lectures on the Physiology and Pathology of the Central Nervous System, 8vo. Philadelphia, 1860. Of authors who allow at least a large share in the production of many cases of Neuralgia to the centres, are Teale, Treatise on Neuralgic Diseases, &c. London, 1829. C. Handfield Jones, on Functional Nervous Disorders, London, 1864; also Lumleian Lectures, Med. Times and Gaz. 1865, vol. ii. But the most suggestive and important treatise, and one which has been unaccountably neglected, is the Observations on the Functional Affections of the Spinal Cord, by William and Daniel Griffin, London, 1834. I have, in the text, given Valleix just credit for laying the foundations of the current knowledge respecting Neuralgia; but it must be allowed that in the work of the Griffins, which is little known, there are the germs of a great improvement of that knowledge. Of essays which illustrate the serious secondary complications which may attend Neuralgia, the following may be mentioned, besides the treatises of Barensprung, of Notta, the work of the Griffins, and other papers already specified:—Schiff, Hyperæmia of the Eye, Ulceration of Cornea, &c. after a Wound of the Superior Maxillary Nerve; Untersuch, p. 116. Allcock, Disease of the Eye from injury to the Infra-orbital Nerve. Todd's Cyc. of Anat. and Physiology, vol. ii. p. 132. A great many cases also are quoted in Handfield Jones's Lectures on Functional Nervous Disorders, already cited.

It is only just to Dr. Handfield Jones to acknowledge that he has long advocated the opinion that nerve-pain is invariably, and in all its phases and consequences, an expression of debility of function; an opinion which has been strongly expressed also by myself not only in the present article, but in many other papers.

V.

LOCAL PARALYSIS FROM NERVE DISEASE.

By J. WARBURTON BEGBIE, M.D., F.R.C.P.E.

THERE can be no doubt that for a lengthened period, and till a comparatively recent date, the attention of pathologists was too exclusively directed to the great nervous centres in explanation of the causes of nearly all nervous disorders, including paralysis. So much so was this the case as fully to justify the language employed by the late Dr. Graves, of Dublin. "If," says he, "you examine the works of Rostan, Lallemand, Abercrombie, and those who have written on diseases of the nervous system, you will find that their inquiries consist in searching after the causes of functional changes, either in the cerebrum, cerebellum, or spinal marrow, forgetting that these causes may be also resident in the nervous cords themselves or their extremities, which I shall call their circumferential tracts."[1] Since 1843, however, when the first edition of Graves's lectures appeared, it has been satisfactorily determined by physiological investigation and by the careful observation of disease in numerous examples, that paralysis, or the loss of the power of motion, may result from one or other of two causes. It may depend either on a central nervous lesion, that is, a lesion of the Brain or Spinal Cord, or on an abnormal condition of a particular nerve in some part of its course. It is with the latter, as giving rise to a local form of paralysis, that we are now exclusively concerned. We are abundantly familiar with the effects of mechanical injury as applied to nerves. When a nerve is cut across there results immediately a paralysis of the parts below the section supplied by that nerve. Further, if a nerve be included in a ligature, or subjected from any cause to much pressure, a similar result is produced. The paralysis of the arm caused by pressure on the axillary plexus of nerves, is an excellent and familiar illustration of injury so occasioned. It is thus described by Dr. Todd: "A man gets intoxicated, and falls asleep with his arm over the back of a chair; his sleep under the influence of his potations is so heavy, that he is not roused by any feelings of pain or uneasiness, and when at length he awakes, perhaps at the expiration of some hours, he finds the arm benumbed and paralyzed. It generally happens that the sensibility is restored after a short time, but the palsy of motion continues. Cases of this kind sometimes derive benefit from galvanism, but if the pressure which caused the paralysis has been very long continued, they seldom come to a favourable termination. Nerve-tissue is one which never regenerates quickly, and seldom completely, so that great or long continued lesion of its structure is not likely to be removed."[1] Although by no means so distinctly witnessed as the result is, in the class of cases now referred to, there seems no reason to doubt that, equally with mechanical injury, interference with the proper nutrition of nerves may lead to forms of local palsy. Illustrations of such occurrences will be adduced more especially when directing attention to one of the most interesting of all the varieties of local paralysis, namely, facial palsy. Again, familiar as we are with the action of various poisons, such as alcohol, opium, chloroform, on the great nervous centres, and on the same portions of the nervous system of certain poisons formed in the living body, as urea, and the morbid materials in rheumatism and gout; having also important knowledge regarding the influence which is exerted on the nervous and muscular systems generally, but especially on the nerves and muscles of the upper extremities by the poison of lead, we cannot hesitate to account, in a manner closely similar, for the other forms of local paralysis which from time to time present themselves to our notice.

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[1] Clinical Lectures on the Practice of Medicine, Lecture xxxiii.

Dr. Todd alludes to cases of local paralysis occurring in states of the constitution which, if not rheumatic, are at least allied to it, and associated with imperfect action of the kidneys. "Of this," he says, "the following affords a good example: A medical man, ætat. 53, extensively engaged in practice in the county of Bucks, applied to me in August, 1847, with complete paralysis of the deltoid muscle. He was a stout, full man, tall, of large build, and very active in his habits; fed well, and drank beer, but not to excess. He had been subject to a shifting neuralgia of the scalp, and to a discharge from the right ear, where he thought the tympanic membrane was destroyed; he was deaf on that side. Six weeks before he came to me he suffered from pain in the left side of the neck and shoulders, followed by complete paralysis of the left deltoid muscle and weakness of the whole arm. On examining, I found a total inability to raise the left arm to a right angle with the trunk, or to perform any of those actions which are usually effected by the deltoid muscle, which was very much wasted. He could, however, grasp perfectly with the left hand, and execute all the other movements of the arm and forearm. There was some degree of numbness of the arm. There were no symptoms distinctly referable to the head. His tongue was coated; appetite good; the discharge from the ear had ceased. The urine was pale, of low specific gravity, and contained albumen in small quantity. I viewed the case as one of local palsy, connected with a deranged state of system, rheumatic or gouty. I regulated his diet, and gave him small doses of the mineral acids. After a fortnight of this treatment he improved considerably, and could raise his arm slightly. The albumen in the urine had much diminished; and crystals of lithic acid were precipitated. He was now ordered three grains of iodide of potassium, with ten minims of liquor potassæ thrice daily. He only followed this treatment for ten days, as the iodide of potassium purged him. Still, he was improving, I continued the liquor potassæ, and advised galvanism to the muscle. This plan was diligently pursued for a fortnight, at the end of which time he had so far improved that he could raise his arm nearly to a right angle, he could put on his coat, and tie his cravat; and in three weeks more he was quite well. All signs of albumen had disappeared from his urine."[1] The writer's experience has furnished cases bearing a remarkable resemblance to the one now quoted. He calls to remembrance more especially that of a young and plethoric as well as highly rheumatic female, who suffered from paralysis, succeeding severe pains of the left lower extremity, and in whom a plan of treatment which secured the copious discharge of urine, previously much diminished as well as disordered, and free action of the skin, proved eminently successful in removing the palsy of the limb. Besides the gouty and rheumatic poisons, it is well to keep in view the very decided action of the syphilitic in inducing this among other local disorders. No one calls in question the injurious effects which are capable of being produced on the nervous centres by the syphilitic poison; there is, however, good reason to believe that some local palsies are thus created. The writer has been able to trace the occurrence of paralysis of the portio-dura, of paralysis of the third pair, as shown by a marked ptosis; and also of palsy of the limbs, slight although threatening, to the same cause, when neither brain nor spinal cord appeared to be implicated. And it is probable that the experience of many physicians has not been dissimilar to his own, in finding the iodide of potassium administered in large doses, and steadily persevered with, a most useful remedy in such cases, relieving the palsy as effectually, as it is so frequently the means of doing, the neuralgic and wearing-out headache, or the painful node on the shin-bone, which are evidently due to the same cause. Allusion has been made to the influence of direct pressure external to the body, in producing such injury of nervous structure as leads to a form of local paralysis. Palsy thus induced is generally merely temporary in duration. Tumours within the body, involving nerves, are frequently the direct occasion of local palsies. No more interesting variety of such palsy exists than that which is due to the interference with the recurrent or motor laryngeal nerve produced by an aneurism of the arch of the aorta, or by a cancerous mediastinal tumour. Well-marked atrophy of the muscles of one side of the larynx has under such circumstances been found. The dyspnœa, which is induced by the implication of the vagus, or as sometimes happens of the phrenic nerves in strumous or tubercular tumours, is abundantly recognized since the writings of Risberg and Ley. There seems reason to believe likewise that pressure upon or other injury of some parts of the sympathetic nervous system may occasion local palsies. Of this the paralysis of the radiating fibres of the iris caused by cutting the sympathetic in the neck in Budge and Waller's experiments, but especially a similar contraction of the pupil to that physiologically produced, due to the pressure of aneurism projecting into the neck or malignant tumour similarly situated, are now quite familiar to the physician.

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[1] Clinical Lectures on Paralysis, certain diseases of the Brain, and other affections of *the Nervous* System, Lecture i.

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[1] Loc. cit., p. 72.

Attention will now be directed to some of the more important varieties of local palsy dependent on nerve disease, and first to *Facial Palsy*. This most interesting local paralysis is known under different names, of which the more commonly employed are *Facial Hemiplegia*, *Histrionic Paralysis*, *Bell's Palsy*, and *Paralysis of the Portio-dura*. Occurring as it usually does on one side of the face only, nothing can be more striking than the peculiar features of the disease. This is owing to the palsied condition of a few or all of the superficial muscles—the muscles of expression—on the affected side, and the heightened antagonism of muscular action on the unaffected side. The patient cannot knit the forehead,[1] neither can the eyebrows be raised or drawn together. The eye remains open, as the power of closing the lids is lost, and their blinking movement no longer exists. This open condition of the eye, seen both in waking and sleeping, and which is due rather to the increased action of the levator palpebræ muscle than to the palsy of the orbicularis palpebrarum, is a characteristic, it has indeed been styled a pathognomonic feature of facial palsy.[2] The ala nasi is dependent, and on full inspiration on smelling or blowing the nostrils there is no expansive movement. The angle of the mouth hangs down. Further, the patient cannot whistle, for he is unable to purse up his mouth for that purpose, and for the same reason he can neither spit, nor can he distend the buccal cavity with air, or blow wind from the mouth. Pronunciation of labials is notably impaired. The saliva and fluids frequently trickle from the mouth. In mastication portions of food are apt to collect between the cheek and gums, as the support of the lips and cheeks necessary for its proper performance is lost. Let the patient laugh, cry, sneeze, yawn, or be the subject of any violent emotion, and the distortion of the features becomes much more conspicuous, the face being forcibly drawn to the sound side. Motionless and void of expression is the one side, contrasting in a very remarkable manner with that on which intelligence remains visible and power of movement unaltered. Trickling of the tears down the cheek, owing to the immobility of the lower eyelid, with consequent dryness of the corresponding nostril, and redness of the conjunctiva, it may even be severe conjunctivitis, determined by the operation of cold, dust, or other external influences on the constantly exposed eye, are among the accompanying phenomena of this palsy.

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[1] In alluding to the smoothness of the brow in the aged, who are affected by facial palsy, owing to the disappearance of all wrinkles, Romberg facetiously observes, "für alte Frauen kein wirksameres Cosmeticum existirt."

[2] "The leading character of cases of facial palsy," writes Dr. Todd, "is the inability to close the eyelids, from paralysis of the orbicularis palpebrarum; this is the pathognomonic sign which determines the peculiar nature of the palsy, and distinguishes it from the most serious form of facial palsy, which is dependent on disease of the brain and palsy of the fifth or third nerve." (Clinical Lectures, Lecture iv.)

To Sir Charles Bell we are indebted for pointing out the true nature of this affection. He showed that one nerve only was involved, that the muscles governed by the portio-dura of the seventh pair were alone affected, that strictly it is a local palsy. The sensibility of the face is usually unimpaired ; a slight affection of the filaments of the fifth may, however, cause a little facial pain, but that is to be accounted rare. In instances of long standing facial palsy, Romberg has drawn attention to the relaxed and flaccid condition of the skin covering the affected muscles, while Dr. Todd has insisted on increasing flaccidity of the cheek, and especially a rapid development of that condition, as a symptom of unfavourable omen as regards the patient's prospects of recovery. But while this form of local palsy is clearly dependent on lesion of one nerve only, there is reason to believe, as Romberg has more particularly shown, that its features are subject to modification, according to the precise seat of the disease. That may be *peripheral* or *central*. Not only so, but the diagnostic marks may vary under the former head, according as the superficial distribution of the portio dura, or the nerve as it passes through the temporal bone or the nerve within the cranium and near its central origin, is affected. Viewing these very briefly in their order, it may be remarked—that, *facial palsy, due to an affection of the superficial distribution of the nerve*, is generally met with as the result of exposure to cold.[1] "A very common cause of this palsy," writes Dr. Todd, "is the influence of cold; as by exposure at an open window, in a coach or railway carriage, to a current of cold air."[2] "A blast of cold air on one side of the face," remarks Dr. Graves, "has been known to cause paralysis and distortion of several months' duration."[3] External injuries, such as blows on the cheek, and surgical operations on the face, have been followed by this form of local palsy. Of the cases which occur, there are not a few in which no traumatic cause can be found, neither can any marked exposure to cold be traced. In such circumstances it is proper to make a very careful inquiry into the condition of general health of the sufferer, when, it is not unlikely that the connection of the palsy with a gouty or rheumatic taint may be satisfactorily established. Dr. Todd, alluding to the dependence of periodical neuralgic affections on the determination of some poison to a particular nerve, as the paludal poison or some matter generated in the system, expresses the opinion that morbid matters may affect a motor nerve just as they affect a sensitive, causing in the former case paralysis, as in the latter they determine neuralgia.

Facial Palsy caused by an affection of the portio-dura in its passage through the temporal bone.—The connection of this paralysis with local strumous affections in children is well known. These may be simple and easily remediable, as for example the parotid and more general glandular enlargements consequent on measles, scarlatina and other disorders; but of much more serious nature is the otitis resulting in caries of the petrous portion of the temporal bone. Here the palsy is associated with deafness, and very probably also with purulent discharge from the meatus. Direct violence, likewise, as in a case related by Sir Charles Bell, in which a pistol shot through the ear had splintered the bone, and torn the nerve in its osseous canal, may of course determine the palsy. The diagnosis of the disease or injury affecting the nerve, in its passage through the bone, rests, according to Romberg, not only on the coexistence of such phenomena as otorrhœa, removal of necrosed portions of bone, perhaps of one or other of the small bones of the ear, and deafness—symptoms which are not likely to occur in cases of simple peripheral facial palsy, but further, upon certain peculiarities in the observed paralytic phenomena. One of these is the diminution of taste on the side of the tongue corresponding to the palsy, another is a unilateral paralysis of the velum palati. On the latter point the statements of writers have been very contradictory. Romberg remarks that in four patients afflicted with facial palsy he has noticed the paralyzed condition of the velum palati, the uvula, having a slanting direction, being arched and the tip pointed to the paralyzed side. While failing to offer any explanation of the peculiar position of the uvula, Romberg evidently attaches very great importance, in a diagnostic point of view, to the palsied condition of the velum, and the marked curving of the uvula; concluding, from their existence, that the seat of the disease *must* be in the petrous portion of the temporal bone. And he again emphatically repeats when the disease is in the peripheral distribution of the nerve, the velum is not affected, "wovon ich mich in vielen Fällen überzeugt habe." It is the implication in the diseased condition, of whatever nature that may be, of the nervus petrosus superficialis major, of Arnold—which taking its origin from the knee-shaped bulb on the trunk of the portio-dura as it lies in the Fallopian aqueduct, and which communicates with Meckel's ganglion, whence the muscles of the palate derive their nerves—that in the view of Romberg causes the displacement of the velum and uvula. Dr. Todd, while admitting the occasional occurrence of this phenomenon, combats the notion of Romberg, and maintains that undoubted instances of disease of the aqueduct, causing paralysis of the nerve, are met with, in which affection of the velum does not exist. In his own experience the symptom in question was of very rare occurrence, and he regarded it as a coincidence. Since the publication of the views of the authors now referred to, the paralysis of the palate in facial palsy has received renewed attention from M. Davaine and Dr. Sanders. The former recorded one case of unilateral paralysis of the palate, in connection with facial palsy of right side, observed by himself, and has commented on several instances furnished by Romberg and others. His description of the phenomena he observed is given as follows: "The velum palati is not regular; the arch formed by the right anterior pillar is less elevated than the left. The posterior pillar of the same side descends directly downwards, without being curved like that of the other side. The uvula is bent like a bow; its point is directed forwards and towards the paralyzed side, while its base is carried a little towards the sound side. The patient's voice is slightly nasal."[1] Dr. Sanders, in a valuable paper,[2] gives an interesting case of paralysis of the velum in connection with facial palsy of the right side, and enters at some length into a consideration of the mechanism of the deviation of the palate. Dr. Sanders is satisfied that a partial hemiplegia of the palate does exist in connection with facial palsy, and, like it, is dependent on affection of the portio-dura. He believes that this form of palatal palsy consists in a vertical relaxation or lowering of the corresponding half of the velum palati, with diminished height and curvature of the posterior palatine arch, on the paralyzed side, and that it is due to paralysis of the levator palati—that muscle and the azygos uvulæ, also supplied by the seventh pair, being the only muscles affected. Among several conclusions at which Dr. Sanders has arrived, the following appear to be specially important: that the partial paralysis of the velum in facial palsy, due to implication of the levator palati muscle, is by no means so rare as palsy of the velum (hitherto not accurately described) has been generally supposed; and that the prognosis is not necessarily rendered more unfavourable in facial palsy when the palate is implicated.

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[1] Some writers speak of facial palsy as specially a disease of northern climates. Thus, Joseph Frank, after alluding to the collection of cases by various authors, remarks, "Nosque plurima vidimus. Morbus iste in regionibus septentrionalibus tam communis est, ut spatio quindecim annorum viginti duo mihi obvenerint exempla." (De Paralysi, Praxeos Medicæ Universæ Præcepta.)

[2] Loc. cit., p. 69.

[3] Loc. cit., p. 380.

The lesion in facial palsy may exist at the cerebral origin of the seventh pair of nerves. We are not, however, called upon to consider this variety of facial palsy: suffice it to say, that its existence may be determined, and the differential diagnosis, between it and the other forms—already briefly considered—established, by the occurrence, sooner or later, of symptoms due to the implication of other nerves, such as deafness, strabismus, ptosis, and anæsthesia. While, either the presence of inflammatory products, or apoplectic extravasations in the vicinity of the pons Varolii may be the precise lesion which gives rise to the palsy, the probability is that, in such cases, a tumour of one nature or other, and subject to gradual extension, exists.

The duration of Facial Palsy is subject to considerable variety according to the precise seat and nature of its determining lesion. Dr. Todd remarks that "it rarely, if ever, lasts a shorter time than ten days, whilst it very often extends to as many weeks; perhaps three or four weeks may be assigned as an average duration for the non-traumatic cases; and Romberg warns us not to expect its duration to be brief. It is in those cases which have been evidently connected with rheumatism that he has found the paralysis least enduring.[3]

The writer has seen simple cases of the disease, in so far as their cause was concerned, lasting a very lengthened period, many months, and even a year.

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[1] Gazette Médicale de Paris. 1852.

[2] Edinburgh Medical Journal, August, 1865.

[3] "Die Dauer der mimischen Gesichtslähmung ist selten kurz. Am kürzesten fand ich sie bei der rheumatischen: doch habe ich sie auch hier in günstigen Fällen nur selten unter sechs Wochen wahrgenommen, einmal sah ich die Heilung innerhalb acht, ein andermal in vierzehn Tagen." p. 664.

It is incumbent on the physician to be very careful in offering an opinion as to the prognosis in cases of facial palsy: that must always be founded on a consideration of the probable cause. Those cases are nearly certain to terminate favourably in which cold or rheumatism are to be looked upon as the determining agents. On the other hand, when the palsy has been due to mechanical injury the prognosis cannot be favourable, and this very specially in those instances where a division of the nerve has been caused. We cannot be too careful in the expression of our opinion in cases characterized by nerve disease within the temporal bone. The records of medicine contain reports of such, which have given rise to meningeal inflammation, intracranial, even cerebral and cerebellar abscess and death.

If prognosis is to be guided by a just consideration of the causes, so also is the treatment of facial palsy when amenable to cure. The remedial measures at our disposal may be conveniently classed under the heads of internal and external agents. In the use of the former, regard should always be had to the diathetic condition of the patients, rheumatic, gouty, strumous, syphilitic, anæmic, or suffering from the injurious influence of a paludal poison. We are disposed to think that this is one of the forms of local palsies in which the loss of power may be due to changes in nerve structure determined by neuritis. In such examples, and still more so if there be reason to conclude that a syphilitic taint is in existence, iodide of potassium will prove a most serviceable remedy. We have ourselves found it to be so. The iodide should be administered in doses of five grains twice or thrice daily, simply dissolved in distilled water. The efficacy of the remedy is secured by its being administered while the stomach is empty, but food may be taken very shortly thereafter. Should a rheumatic or gouty habit be found in connection with the palsy, alkaline remedies, colchicum, and lemon-juice, may exert a beneficial influence, and so probably will quinine or arsenic in the not unknown examples of the disease allied to intermittent fevers. Mercury in the form of blue pill has been extolled by several practitioners. Sir Thomas Watson counsels the exhibition of mercury "so as just to touch the gums," adding, "I should always take this precaution, lest any effusion of lymph should cause abiding pressure on the nerve."[1] Iron is likely to be useful when an anæmic condition of the system exists. The muriate of lime, the iodide of iron, and cod-liver oil, are available remedies when a strumous cachexia obtains. The writer can bear a decided testimony to the therapeutic value of strychnine as an internal remedy in one long-existing instance of the disease, which had bid defiance to the more ordinary remedies; he cannot, therefore, coincide in the observation of Dr. Todd, that "Strychnine is of no use in such cases."

As to external remedies. Blisters, strongly recommended by some physicians, are discountenanced by others, on the ground that they sometimes cause enlargement of the neighbouring glands, which by pressure may in their turn injuriously influence the nerve twigs. Local hot fomentations and the application of leeches are very useful remedies at an early period of the disease, the employment of the latter being generally limited to persons of full habit, and otherwise in the enjoyment of fair health. The endermical application of strychnine—over a blistered surface—the use of various stimulating liniments, and particularly, in the writer's opinion, galvanism, are the more approved remedies in cases which have lasted for a little time.

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[1] Lectures, vol. i. p. 563.

Before concluding our notice of facial palsy, we must add a few remarks on the occasional occurrence of the disease on both sides of the face, and very briefly refer to the statements of Dr. Todd respecting the integrity of the seventh pair in cases of cerebral hemiplegia, a view which has recently been ably controverted by Dr. Sanders.

Double Facial Paralysis.—This is unquestionably a rare affection, and especially rare when the double palsy is solely dependent on nerve disease. Romberg and Dr. Christison[1] refer to cases of what may be styled simple bilateral paralysis of the face, while the seventeenth case in Dr. Todd's lectures is a very remarkable example of paralysis of the portio-dura on both sides connected with affection of the portio-mollis; for the patient was "perfectly deaf in both ears;" and the loss of function of both branches of the seventh pair evidently resulted from disease in the temporal bone. In addition to the writers already named, M. Davaine has especially directed attention to the subject in a valuable memoir, the title of which is given below,[2] and to which Professor Gairdner,[3] of Glasgow, in giving an account of a very interesting case of double facial palsy, has referred. Dr. Gairdner considered the paralysis to be due to cold, and connected with rheumatism of the external branches alone; and in the course of his paper he alludes to another case of double paralysis of the portio-dura evidently connected with syphilis. In the latter case iodide of potassium, with iodide of mercury and corrosive sublimate, were employed in alternate doses, and the result was an excellent recovery. One example of double facial palsy has occurred under the writer's observation; it was associated with tubercular disease within the chest, and the patient, a man of thirty years of age, subsequently died of what appeared to be strumous meningitis. Unfortunately an examination of the body after death was not permitted. This is scarcely the opportunity for entering on a consideration of the view which was so strongly entertained and expressed by the late Dr. Todd, that the seventh nerve was very rarely involved in facial palsy depending on cerebral disease, and that the affected facial muscles were those governed by the fifth pair. It will, however, tend to complete the brief exposition of facial paralysis now given, if we state in this connection, that there is, in our opinion, no reason to doubt that the view taken by Dr. Todd, and in which several systematic writers in this country have closely followed him, is erroneous, and that, on the other hand, the current doctrine on the Continent, and which has been recently ably unfolded and extended by Dr. Sanders, is correct, viz: "that in cerebral hempilegia, as in peripheral face palsy, it is the motor seventh nerve which is affected."[1]

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[1] Monthly Journal of Medical Science, 1850.

[2] Mémoire sur la Paralysie générale ou partielle des deux Nerfs de la septième paire: lu à la Société de Biologie (Mars, 1852) par M. C. Davaine. See also Gazette Médicale de Paris, 1852.

[3] Clinical Observations, Lancet, May 18, 1861.

Disease of other of the motor cerebral nerves than the portio-dura may likewise determine local palsies. A short reference to such may be made here.

Paralysis due to disease of the third pair of nerves. (Oculo motor.) Ptosis or blepharoplegia, the falling down of the upper eyelid, is the notable feature of this affection. When this is due to a cause seated within the cranium, such as an inflammatory exudation, or a tumour, it is almost invariably accompanied by palsy of those muscles of the eyeball, and those fibres of the iris which are likewise governed by the motor oculi. Hence in such cases, and they are far from being uncommon, external squint and dilatation of the pupil are associated with the ptosis. Not only so, but other adjacent cerebral nerves are for the most part implicated, while the indications of the existence of some formidable cerebral lesion are under such circumstances not likely to be absent. On the other hand, when the determining cause of the local paralysis is peripheral in its seat, the ptosis exists alone. Romberg remarks that rheumatism may be the cause of paralyzing the palpebral branch of the motor oculi, although not so frequently as is the case with the facial nerve; and he distinctly states that when so induced, the ptosis occurs without the participation of the muscles of the eyeball, and the contractile fibres of the iris.[2] The writer remembers to have seen this dependence of ptosis on rheumatism illustrated in the case of a young lady, who after having frequently suffered from distinct rheumatic affections, became within a limited period the subject of facial palsy and ptosis, the immediate peripheral impression on both the seventh and third nerves being evidently due to severe cold. A complete and speedy recovery occurred after the local application of warmth and the use of anti-rheumatic remedies. M. Marchal de Calvi has directed attention to the occurrence of oculomotor paralysis, consequent on very severe tic of the face. M. Marchal, and likewise the late M. Jobert de Lamballe, found the muscles of the eyeball affected as well as dilatation of the pupil, the vision[3] disordered, and insensibility of the conjunctiva in this affection. Such cases, however, are rather illustrative of the reflex form of paralysis, our knowledge of which has been of late greatly increased by the observations of M. Brown-Séquard and others.

In the same way as peripheral affection of the oculo motor nerve exists, so may local paralysis result from disease of the *fourth pair* (*trochlear*), and of the *sixth pair* (*abducens*). Such are, however, much less frequent in their occurrence, and specially so, as Romberg has observed, that resulting from affection of the abducens. The author just named has made reference to a case seen by Dr. Dahling, and published by Stromeyer, in which the facial and abducens nerves on the left side were paralyzed in consequence of a sudden cooling of the heated face.

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[1] On Facial Hemiplegia and Paralysis of the Facial Nerve, by Wm. R. Sanders, M. D. Lancet, 1865. See on the same subject Dr. Hughlings Jackson in Clinical Lectures and Reports of the London Hospital, 1864.

[2] "Der rheumatische Anlass paralysirt, obgleich nicht in solcher Frequenz wie den Facialis, den Ramus palpebralis des Oculomotorius und hat eine einfache Blepharoplegie ohne Theilnahme der Augenmuskeln und der contractilen Irisfasern, nach der Norm der isolirten Leitung, zur Folge." (Augenmuskellähmung.)

[3] Mémoire sur la Paralysie de la troisième paire consécutive à la Névrose de la cinquième. (Archives Génerales de Médecine. Juillet, 1846.)

Palsy of the tongue from affection of the hypoglossus nerve in its distribution is of great rarity, offering a marked contrast to the frequency with which a central lesion gives rise to the same form of local palsy.

The lesser branch of the fifth pair may be the seat of disease, and consequently give rise to masticatory palsy. The movements of the face in mastication on one or on both sides, as the case may be, are thus arrested or impeded. The temporal and masseter muscles are readily recognized to be inactive; and their condition when the disease is unilateral offers to the touch a marked contrast with the firmness of the same muscles on the unaffected side during the process of mastication. This variety of local palsy, when due to disease of the nerve, is generally caused by tumour of the dura mater, or disease of the sphenoid bone, or such a morbid condition of the Casserian ganglion as compresses the nerve itself.

VI.

LOCAL SPASMS.

BY J. WARBURTON BEGBIE, M.D., F.R.C.P.E.

THE term *Spasm* (*spasmus*, from σπάω, I draw) is used to indicate the sudden and involuntary contraction of muscular fibres, or of muscles. *Hypercinesis* (ὑπὲρ, in excess, κίνησις, motion) is likewise employed in a sense precisely similar. This peculiar vital phenomenon may be general or local, involving apparently all, or nearly all, the muscles of the body, or, on the other hand, limited to a few muscles, it may be to one.

In every occurrence of Spasm there is increased action of the motor nerve, the result of which is the sudden contraction of muscular fibres, the act itself being wholly removed from the control of the will. The expressions *clonic* and *tonic* are used, the former to denote a Spasm which is characterized by rapidly alternating contraction and relaxation of muscular fibres, while the latter implies the existence of the contractions for a certain time, and of this condition rigidity of the affected muscles is also an invariable feature.

Attention is now to be directed to *local* as distinguished from *general* or universal spasms. To the latter, the term *convulsions* is correctly applied.

Local Spasm is not necessarily attended by pain, but it generally is so, and as expressive of painful Spasm we find a suitable term in *cramp* (Saxon *kramp*). The term *cramp* is most frequently applied to painful muscular contraction in the extremities, and to the same phenomenon affecting the stomach or intestines, and also the heart. Such pain as occurs in connection with Local Spasm is in all probability due to injury done to the sensory nerves supplying the muscle during its violent contraction.

Both kinds of muscular fibre, both orders of muscles, the voluntary and involuntary, are liable to be affected by Spasm. Of the former the most familiar illustration is cramp in the extremities. Of the latter are cardiac and intestinal Spasms. Romberg has pointed out that, as a general rule, when the muscles of animal life, those under the control of the cerebro-spinal nerves, are affected by Spasm, the fibres exhibit a uniform contraction throughout their whole extent, while, on the other hand, the muscles of organic life, over which the sympathetic system is dominant, when similarly affected manifest successive contractions, moving like waves.[1]

It need scarcely be observed that, although the abnormal condition now described as Spasm is evidenced by a disorder of muscular fibres or muscles, the cause of this disturbance is always resident in the nervous system. There is a very important and interesting variety in the connection which subsists between the nervous stimulus and the phenomenon of muscular contraction. The former may be central, that is, operating directly on the great nervous centres, the brain, or spinal cord; or, and in the case of Local Spasm this is far the more frequent, the irritation is peripheral, and consequently the induced action is reflex.

Our knowledge of the causes of Local Spasms is as yet far from being perfect, and in not a few instances the attempt to determine these, notwithstanding the most careful inquiry, signally fails. The etiology of general convulsive disorders is indeed more advanced, and may serve to elucidate doubtful points in relation to the more limited and less serious affection.

The late Dr. Graves of Dublin was one of the earliest to direct attention to the frequency with which various nervous affections, of which Spasm is one, and not the least interesting, are dependent on reflected nervous irritation. He has graphically described the sudden and complete relief afforded to a young lady who had suffered most severely from spasmodic cough after the discharge of a tapeworm, which had been effected by a large dose of oil of turpentine with castor oil.[2] The subject thus adverted to by Graves has more recently attracted the attention of several competent observers, more especially of M. Davaine in France,[3] and Dr. Heslop[4] of Birmingham. Their statements show that the presence of worms in the intestinal canal is a frequent cause of remote nervous phenomena, including Spasms, and throw doubt on the assertion of Romberg, that the influence of worms in producing convulsions has been formally over-estimated. Again, a careful study of the whole phenomena in that most interesting disease, *spasmodic asthma*, has led to the conclusion that the spasmodic affection in it, seated in the smaller bronchial tubes, may be induced by an irritation of the nervous system, which is either centric or eccentric. In the former case the irritation is in the nervous centres themselves, the brain, or spinal cord. In the latter, and it is by far the more common in its occurrence, the irritation is applied at a distance from the nervous centres. This subject has been very fully and ably illustrated by Dr. Hyde Salter, in whose work examples the most interesting and conclusive as to the essentially nervous origin of the asthma are to be found.[1]

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[1] Romberg, Lehrbuch der Nervenkrankheiten des Menschen. Hypercineses, Krämpfe.

[2] Clinical Lectures, Lecture xl., Bronchitic Asthma, Cough.

[3] Traité des Entozoaires. Paris, 1860. M. Davaine remarks: "Tous les organes, pour ainsi dire, peuvent ressentir l'influence sympathique des vers du canal intestinal: la fausse perception des odeurs, la dilatation de la pupille, l'amaurose permanente ou passagère, l'exaltation de l'ouïe, la perversion du goût, le prurit et les fourmillements à la peau témoignent de l'action sympathique des vers sur les sens; d'un autre côté, la somnolence ou les vertiges, les rêves fâcheux, *les spasmes*, les douleurs vagues, la toux, la dyspnée, les palpitations, les intermittences du pouls, la faim insatiable ou l'anorexie, la salivation, la qualité des urines, l'amaigrissement témoignent également de leur action sur le système nerveux, sur les organes de la respiration, de la circulation, de la digestion, sur les sécrétions, enfin sur la nutrition."—Page 48.

[4] The Cerebro-spinal Symptomatology of Worms, especially Tapeworms. Dublin Quarterly Journal of Medical Science, vol. xxvii. 1859.

In treating of what may be styled central asthma, Dr. Salter gives, among others, the following case: A man about fifty was subject to epilepsy. His fits had certain well-known premonitory symptoms, and occurred with tolerable regularity about once a fortnight. On one occasion his medical attendant was sent for in haste, and found him suffering from violent asthma. The account given by his friends was, that at the usual time at which he expected the fit he had experienced the accustomed premonitory symptoms, but instead of their being followed as usual by the convulsions, this violent dyspnœa had come on. Within a few hours the dyspnœa went off, and left him as well as usual. At the expiration of the accustomed interval after this attack, the usual premonitory symptoms and the usual epileptic fit occurred. On several occasions this was repeated, the epileptic seizure being as it were supplanted by the asthmatic. Nothing seemed to be amiss with the lungs either before or after the attack. Dr. Salter truly observes, that such a case as this appears to admit of only one interpretation, that the particular state of the nervous centres that ordinarily threw the patient at certain times into the epileptic condition, on certain other occasions, from some unknown cause, gave rise to bronchial spasm; that the essential diseased condition was one and the same, but that its manifestation was altered, temporary exaltation and perversion of the innervation of the lungs in the asthmatic paroxysm supplanting unconsciousness and clonic convulsion in the epileptic seizure. It has occurred to the writer to witness in one instance an alternation of phenomena bearing a close resemblance to that observed by Dr. Salter. The patient, a young man, was admitted to the Royal Infirmary of Edinburgh, on the recommendation of Dr. Turner, of Keith. He had for several months previously been subject to cerebral attacks, attended by loss of consciousness, and occasionally by convulsive movements of the muscles of the face and extremities. These continued to occur during the patient's residence in the hospital, observing for a time the same periodicity which had antecedent to that time always distinguished them, when, on three separate occasions, and in the most distinct manner, an attack of asthma took the place of the more manifest cerebral disorder. The loss of consciousness and convulsive movements again recurred in a modified form: and after the lapse of several weeks, during which various remedies were employed, the patient left the Infirmary to return home, his condition having materially improved. Besides instances of the nature just alluded to, there are other examples of asthma, which, although in by no means so distinct a manner, must be held as caused by some impression taking origin in the nervous centres, and responding in a mysterious manner with certain feelings or emotions of the mind; such are the cases in which fear, excitment, and fatigue operate.

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[1] *On Asthma: its Pathology and Treatment.* London, 1860.

Now, passing to a very brief consideration of *bronchial* Spasm, dependent not on centric but *peripheral* irritation. Dr. Salter speaks of three degrees of remoteness of the application of the stimulus producing asthma, and consequently of three groups into which the reflex cases of the disease may be divided: 1st. Those in which the source of irritation is alimentary, and chiefly gastric. 2d. In which the irritation is more remote, but still confined to the organic system of nerves, as, for example, asthma produced by a loaded rectum, by the presence of tapeworm, or ascarides. 3d. Cases in which the cerebro-spinal system is the recipient of whatever irritation is the cause provocative of the attack, as, for example, was illustrated in a most remarkable instance recorded by Dr. Chowne, where the application of cold to the instep produced in the most direct manner the asthmatic paroxysm. Looking to the first, and by a long way the largest, of these three classes of cases, the nerve irritated is the gastric portion of the pneumogastric; through it the stimulus reaches the medulla oblongata, and from that portion of the nervous centre it is again transmitted to the bronchiæ by the pulmonary filaments of the same nerve. It is indeed of the highest importance in a therapeutical point of view to notice this chain of connection. We are thus called to recognize in the paroxysm of asthma a disease not unfrequently originating in disorder of the stomach; and it may be assumed as a correct conclusion, that a large proportion of the sufferers from this severe spasmodic affection are to be relieved by attention being given to their diet and regimen. But even here we should be adopting too limited a notion of the influence of the digestive and assimilating processes in the production of asthma did we conclude that those cases alone are examples of this nature, in which bronchial spasm is induced by reflex stimulation directly through the important nervous trunk—the pneumogastric. There are over and above, numerous instances in which this direct communication of the influence exerted will not apply. In such the occurrence of the Local Spasm does not so speedily follow the introduction of food into the stomach as in many of the former cases, and therefore we must look for a somewhat different explanation. We find it in the disordered condition of the blood; the faulty assimilation is no doubt the primary cause of this, but the unhealthy blood is in such instances the direct irritant; by its operation on the nervous distribution through the lungs the bronchial Spasm is caused. This humoral origin of asthma affords in all probability the most satisfactory explanation of the frequent occurrence of the nervous disorder in persons who are gouty. The accuracy of the view thus expressed is further evidenced by the circumstance that such sufferers are benefited by a plan of treatment which tends to eliminate the essential poison of gout from the system; often, indeed, are benefited by such a plan of treatment only. In these cases remedies need scarcely be directed to the chest: it may be possible to relieve, it is impossible to subdue, by antispasmodics, a bronchial spasm so induced; but on the other hand, by acting freely on the great emunctories of the body, on the skin and kidneys, the disease is to be met and overcome.[1]

Allusion has been made to the production of bronchial Spasm as determined by reflex irritation, and also by an impure condition of the blood. The same precisely holds true of *cardiac* Spasm. The irregular, unrhythmical, and painful contractions of the heart known under the name of *palpitation*, are found in close connection with various derangements of the general health and of special organs. Among the latter, those of the alimentary canal, but particularly of the stomach and the uterus, occupy the chief place. Perhaps the most painful of all the forms of cardiac palpitation is that resulting from either an imperfect depuration of the blood, or from a regular blood impoverishment, or anæmia, as is so frequently observed in cases of amenorrhœa and chlorosis.

We pass to a brief consideration of Spasm as occurring in the muscular organs which constitute the alimentary canal. It affects *the stomach and intestines* as well as the *œsophagus and pharynx*, while the severe pain determined by its occurrence in any part of the alimentary tract is very generally accompanied by other and various symptoms which cannot with any propriety be referred to now. Painful peristaltic spasm of the intestines is usually known under the name of *colic*. During its occurrence, and as affording proof of its occasional violence, *intussusceptio* and prolapsus of the rectum may take place. Foremost among the determining causes of colic is to be placed the presence of indigestible articles of food and morbidly altered secretions in the intestinal canal. But, besides this, the influence of the emotions, and more especially of fear and fright, is well known; while just as bronchial Spasm may be due to reflex nervous irritation, so may intestinal-spasmodic stricture, as it is called, to distinguish a temporary and functional from an enduring and organic contraction, similarly produced, have its seat in any part of the alimentary canal. In some instances the direct exciting cause is seated at a great distance from the induced disorder: of this nature no more common or manifest example can be given than that of colic, often very severe, resulting from the exposure of the lower extremities, it may be of the feet only, to cold and damp. *Spasm of the pharynx and œsophagus* is one of the most interesting of all the varieties of Local Spasms. It is of common occurrence, particularly in females, in whom it shows itself either as a reflex phenomenon dependent on uterine irritation, or—and this still more frequently—as one of the most striking features in a paroxysm of hysteria. It is not always an easy task to distinguish between Spasm of the œsophagus due to organic disease and that which is simply the result of a nervous irritation. The cautious introduction of the probang or œsophageal bougie is the most ready and certain means for establishing the diagnosis.

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[1] Laennec, who, while strongly insisting on the connection between asthma (asthme spasmodique) and catarrh, admitted the existence of a purely nervous asthma (sans aucune complication de catarrhe), has acknowledged the great difficulty there is in the satisfactory treatment of the disease. "Beaucoup de moyens," he remarks, "peuvent être opposés aux troubles de l'influence nerveuse qui constituent principalement l'asthme : *mais ici, comme dans toutes les affections nerveuses*, rien n'est si variable que l'action des médicaments ; les remèdes qui réussissent le mieux chez un grand nombre de sujets sont sans efficacité pour beaucoup d'autres ; et chez le même individu tel moyen qui avait produit d'abord des effets héroïques, et d'une promptitude surprenante devient tout à fait inefficace au bout d'un petit nombre de jours. Il faut successivement en essayer plusieurs, et souvent de trés-disparates : nous allons, en conséquence parcourir les diverses séries de moyens dont on a tiré le plus d'avantage dans l'asthme."—*Traité de l'Auscultation Médiate, Affections Nerveuses du Poumon.*

An irritation of the pharynx or œsophagus, of the stomach, bowels, or liver, is sometimes the direct cause of *hiccup* or *singultus*, a spasmodic affection extremely interesting in its nature. Sudden powerful jerking inspirations, accompanied by a peculiar noise, and succeeded by a brief expiration, interrupting speech, distinguish hiccup. It is essentially a reflex phenomenon; in the vast majority of instances depending on some peripheral irritation, but occasionally, as its presence in apoplexy, meningitis, and hydrocephalus testifies, determined by a central cause. There seems to be some difficulty in accounting for the occurrence of hiccup from an irritation of the phrenic nerve, as has been suggested by various writers; nevertheless it is consistent with the writer's observation in several instances of long-continued and distressing hiccup, that firm pressure exerted for a brief period over the lower part of the neck, corresponding to the situation of the scaleni muscles, so as probably to compress the phrenic, has led to its temporary and even entire arrestment. In singultus and in yawning, which resembles it in being of the nature of inspiratory convulsion—also in *sternutatio* or *sneezing*, where the expiratory function is involved—what is of consequence to notice is, as Romberg has pointed out, that the spasmodic action does not affect a single muscle, but, on the contrary, groups of muscles; and that these Local Spasms, more particularly the former hiccup, while occurring as independent affections, are still more prone to assume the symptomatic character; affording evidence of the existence of some other malady, or distant irritation.[1]

Spasm of the *urinary bladder* and of the *urethra*—what is commonly styled spasmodic stricture—are familiar to the surgeon. Vesical Spasm is not unfrequently a truly reflex phenomenon: this is witnessed on the introduction of the catheter or bougie, when violent and most painful efforts are made to evacuate the organ, even when at the time empty. Romberg insists on the action of the muscles being due to an irritation of the neck of the bladder, that particular part being, as Sir Charles Bell demonstrated, the most vascular and the most sensitive portion of the viscus. It is when the catheter reaches, or the calculus touches, the neck of the bladder, that the ischuria is produced: and the intense pain is seen to subside whenever the irritating body is removed from that particular portion of the organ. The irritation upon which vesical Spasm depends may, as we have seen to hold true of other forms of Local Spasm, be distant from the induced phenomenon. It may be resident in the kidneys, or in any part of the intestinal canal, but very specially in the rectum. Hemorrhoids are a frequent cause of vesical Spasm; and it is well known in how distressingly severe a degree that is apt to occur after the operation of their deligation. Exposure of the surface of the body, especially of the feet, to cold and wet, and depressing mental emotions, act in the same way.

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[1] "Häufiger als auf einzelne Nervenbahnen beschränkt, kommen die krampfhaften Athembewegungen zu Gruppen associirt vor, entweder selbständig, oder was öfter der Fall ist, abhängig, und in Begleitung von andern Affectionen." (Loc. cit., p. 354.)

As our object in this article has been, not to illustrate every example of Local Spasm, but rather to indicate the nature of this special morbid action by a brief consideration of some of its more important and most frequently occurring varieties, we shall now take a very rapid survey of a few other forms, and bring our remarks to a conclusion by offering some general observations with a special reference to treatment. There is a peculiar variety of Local Spasm affecting certain muscles of the face, and giving while it lasts a very strange aspect to the individual. In the *histrionic Spasm of the face*, by which title this affection is known, there are, in the language of Romberg, "grimaces, alternating or lasting, on one side, seldom on both sides, of the face."[1] Pain is occasionally, but by no means necessarily, an accompaniment of the disordered muscular action. A local malady essentially, because affecting the muscles governed by *one* nerve, the seat of the Spasm is in some instances still further localized by there only being one of the branches of the seventh pair involved. Of the latter are *blepharospasmus*, or Spasm of the eyelids, and the *risus caninus*. The peculiar convulsive grin thus named is caused when the molar and labial branches are affected. To it the terms *spasmus cynicus* and *sardonic laugh* are likewise applied. The relation of facial Spasm to chorea must not be overlooked; this association has been frequently noticed: and it is also a matter of not unfrequent observation that the Local Spasm lasts in some cases for a considerable period after the disappearance of the general nervous disorder with which it had been in the first instance connected.

Masticatory Spasm is witnessed in its most formidable degree when, as trismus, it accompanies, or is itself the chief element in, tetanic convulsions. In a much milder degree Spasm in the muscles which are supplied by the motor division of the fifth pair is seen as a reflex action, determined, as in children, by the presence of worms in the intestinal canal, or by the progress of dentition. The Spasm of the muscles is sometimes associated with a grinding of the teeth. To the occurrence of the latter symptom in persons of the gouty diathesis attention was called by the late Dr. Graves. Such grinding of the teeth continued for years as a daily habit, and produced very remarkable changes in the conformation of these organs, affecting sometimes one side of the jaw, sometimes both; so that in confirmed cases the teeth were frequently found ground down to the level of the gums.[2]

Spasm of the muscles of the eye, dependent on an irritation of the third, fourth, or sixth nerves, is seen in *strabismus*—which is to be distinguished from the paralytic form by the movement of the eyeball in other directions being in the former case possible—and in *nystagmus*. These spasmodic affections equally with others acknowledge a peripheral or central origin. Both are of common occurrence in connection with intestinal and dental disorders, but they are also not unfrequently the indications, sometimes among the very earliest, of mischief, inflammatory or otherwise, commencing at the base of the brain.

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[1] Loc. cit. "Mimischer Gesichtskrampf."

[2] Clin. Med., "Gout."

Painful Spasms of the muscles of the extremities are of very frequent occurrence; and with this affection, more especially seated in the lower limbs, and there in the calves, we are especially familiar under the name of *cramp*. The attack of cramp is usually sudden; and it frequently occurs at night, the person in bed being awakened from sleep by the seizure. During its continuance the muscular fibres are gathered up into a hard knot, which is always easily felt by touch, and may often be seen. The pain is very severe, and produces a feeling of sickness and depression, which may even lead to syncope. The patient not unfrequently gives utterance to an irrepressible exclamation or scream. Cramp usually lasts only for a few moments; it may, however, continue for minutes, and even hours. A sudden cessation of the Spasm may occur, or a more gradual relaxation of the muscular fibres ensue; but in either case, if the attack have been at all severe, sufficient injury during its continuance has resulted to the sensory nervous filaments as to cause a feeling of soreness, always increased by touch, and frequently an inability fully to exert the affected limb or other part for some time. The irritation of the sciatic nerve, upon which the painful Spasm of the muscles of the calf depends, is intimately connected with disorder of the stomach and bowels, and is also particularly prone to occur in persons of the gouty and rheumatic habits.

In Asiatic cholera the occurrence of intensely painful cramps contributes, as is well known, largely to the sufferings of its victims. Again, in persons of intemperate habits there is sometimes observed a tendency to the development of severe spasmodic action in the muscles, of the extremities more especially, but likewise of other parts of the body. In one instance which fell under the writer's observation a patient, having recently recovered from an attack of delirium tremens, was seized with most violent and painful Spasm of the muscles of both upper and lower extremities, during which the fingers were powerfully flexed and bent inwards on the palms of the hands, as in the carpal contractions of children. So severe was this case, that a syncopal depression, very threatening in its character, occurred. After lasting for several hours, and exhibiting for many days a marked tendency to recur, the affection passed off, and the patient entirely recovered both health and strength.

In the *treatment* of local, as of general, Spasms, the great object is to remove the cause on which they depend. In the brief consideration of the different varieties of Local Spasm now offered it has been shown that in a large proportion of cases the excited muscular action is induced by reflex action; that the direct exciting cause is a distant nervous irritation. Fortunately the removal, or at all events the lessening, of this irritation is in many instances within the power of our art. Again, in those cases, of the frequent occurrence of which proof has been afforded, which are characterized by a morbid state of the blood, *e.g.*, gouty or rheumatic, we may often be successful in our treatment by paying due attention to the therapeutical indications—in other words, by the employment of an alterative or eliminating plan, suggested by the peculiarity of each individual case. We may as effectually subdue the morbid action of Spasm as we are constantly enabled, by the use of suitable remedies, to relieve that of pain in neuralgia. In addition we possess in various agents a power of controlling or completely removing such excited nervous action as induces Local Spasm: not indeed one upon which we can invariably rely, because we are often disappointed in the results; nevertheless the remarkable therapeutical effects which succeed the exhibition of various of the antispasmodic and calmative remedies is such as to convince us of their efficiency. Our knowledge, moreover, regarding the action of such remedies is on the increase. It is only quite recently that a valuable addition has been made in the bromide of potassium, the operation of which in removing the painful cramps of cholera, not less than in many instances averting the convulsive seizure of epilepsy, has been witnessed by numerous observers.[1]

Pressure firmly exerted on the thigh relieves a violent cramp of the calf, while, according to Dr. Wise, the application of a tourniquet so as to compress the bloodvessels will banish the exhausting muscular contractions in cholera.

Finally, in the treatment of such exalted nervous action as determines Local Spasm, as in the proper management of every form of derangement of the nervous system, however slight or severe, let the potent influence of peculiarity in psychical constitution, and of the ready susceptibility in some to the operation of all manner of external impressions, not be lost sight of.

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[1] See Note on the Therapeutical Effects of Bromide of Potassium by James Begbie, M.D., Edin. Med. Journ. 1866. Also, The Action of Bromide of Potassium upon the Nervous System, by J. Crichton Browne, M.D., Ibid. 1865.

VII.

TORTICOLLIS

BY J. RUSSELL REYNOLDS, M.D., F.R.C.P.

DEFINITION.—A spasmodic condition of the muscles of the neck—generally clonic, but rarely tonic—whereby the head is displaced to one side, or towards one shoulder; occurring almost exclusively in adult life, and characterized by great obstinacy and chronicity.

SYNONYMS.—Wry-neck; spasmodic wry-neck; spasm in the muscular distribution of nervus accessorius Willisii, and of the superior cervical nerve (Romberg).[1]

CAUSES.—So far as I have seen, the male sex has been slightly more frequently affected than the female; but the difference is so small, that its existence is of no diagnostic value. With only one exception, all the cases that I have seen have presented symptoms after thirty years of age; and the majority after forty. There has been no one thing, nor any combination of circumstances, which has occurred with such frequency as to warrant a belief in its operation as an *exciting cause.* Once a strained position, maintained for a long time; occasionally exposure to cold; sometimes a sudden shock, either mental, moral, or physical; and at other times the presence of long-continued anxiety, or the recurrence of pregnancy, has been referred to by the patient as the cause of symptoms; but, in regard of such modes of causation, we can see distinctly that which might lead to disturbance of the nervous system of any kind whatsoever, but we fail to see anything which should conduce to this special form of derangement.

In one case that I have seen the symptoms were preceded by hemiplegia; in another by paralysis agitans of the side from which the head was turned; in a third, and fourth, and fifth, there was previous "writer's cramp;" in a sixth there was histrionic spasm of the face; but in the majority of cases the nervous system had exhibited no prior derangement, and had continued free from ulterior disturbance for a long period of years.

The position in life and the occupation of those who have suffered from Torticollis have varied widely, and I have not been able to attribute the malady with anything like constancy to that common cause of nervous disease—overwork.

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[1] Syd. Soc. Transl. of Manual of Nervous Diseases of Man, vol. i. p. 316.

SYMPTOMS.—There is great similarity in the symptoms presented by different individuals, when once the disease is established, and is free from accidental complications. Sometimes the *commencement* is sudden, but much more commonly it is gradual, and often so insidious at first that the real nature of the malady is overlooked. The patient feels uneasy in the neck, thinks that something is wrong with his cravat, or with his pillow, and only after several months discovers for himself, or is told by others, that his head is not straight. There is with this want of symmetry some uneasiness in the neck, extending from the occipital protuberance downward to one of the shoulders, and sometimes onwards into the arm, or even forearm. As the malady *advances* the uneasiness becomes greater, and sometimes amounts to definite pain, felt usually in the same direction. The pain is increased by voluntary efforts to bring the head into the middle line, but sometimes attains its maximum when the head is carried round to the furthest point possible by the spasmodic movement. The pain is not severe, but generally of dull, aching character; and often is relieved by lying down, and keeping the head still by resting it upon a pillow.

Observed casually, a case of medium severity would give the impression to a bystander that the patient's cravat was uncomfortable, and that he was trying to make it less so by moving the head, in a somewhat restless manner, towards one side; or that he was making some attempt to look at an object on one side of him, which object he could not "get his head round" sufficiently far to see conveniently.

Upon more careful examination it is seen that the head is constantly being moved by a succession of jerks, in such manner that the occiput is depressed, and the chin raised, and that the movement is in a definite direction, hour after hour, and month after month. Early in the case the individual is able so far to antagonize the spasm, by a simple voluntary effort, as to bring the head into the middle line, or even beyond it; but as time passes on this often becomes impossible, and the hands are used to pull the head back again into its proper position.

When Torticollis has existed for a few months only, the head presents a constant series of movements—the spasm and the voluntary effort so balancing one another that the effect is that described above. But when it has lasted for a longer period, the head is habitually "carried on one side;" for the voluntary interference with the spasm, although frequent—if not constant—does not suffice to bring the head into a central position, being overcome by the spasmodic contraction. Sometimes, even under these circumstances, a very strong voluntary effort may restore momentary equilibrium; but the effort is attended by distress, if not by pain, and is often followed by an exaggeration of the spasm.

The muscles of the neck on the side from which the chin is turned are found hard, contracted, and often hypertrophied; those on the opposite side are frequently soft, and sometimes wasted. Early in the history of Torticollis it would seem—so far as my experience extends—that the deeply seated muscles at the back of the neck are most affected; the sterno-mastoid, at such time, being often free from spasm. At a later period the sterno-mastoid is found hard, frequently hypertrophous.

Occasionally the muscles of the shoulder are so involved that the acromion is raised; more rarely the muscles of the face present histrionic spasm; and not unfrequently there is some difficulty in controlling the movements of the arm. I have noticed sometimes difficulty of deglutition, and in a very few cases some morbid condition of motility in the leg; but these symptoms must be regarded as complications rather than conditions of the disease now under consideration; for it more frequently happens that the muscles of the neck are alone involved in the morbid contraction.

As a rule, to which the exceptions are very rare, the spasms cease during sleep; and not only so, but when the patient lies down and supports the head. They are increased by all that lowers or disturbs the general health, and by emotional excitement.

The electric irritability of the contracting muscles I have found much increased when tested by faradisation: the electric sensibility is sometimes so greatly augmented that an interrupted current, not in the least degree painful on the healthy side, was perfectly intolerable when passed through the seat of spasm. It has appeared often that the relaxed muscles, on the side opposite to the contraction, have exhibited less than their normal contractility; but I have never found them so defective that it was impossible to restore the head to equilibrium by their distant faradisation. This battery current, when continuous, and passed through the contracting muscles, relaxes the spasm and allows of temporary equilibrium; but, when interrupted, its action is similar in kind to that exerted by the induced current of faradisation: there is, however, less intensity of contraction, and much less display of elastic sensibility. The effects of either the battery current or of faradisation appear to be singularly transient, in whatever manner they may have been produced. It has often happened to me to see that a head which had been maintained *in equilibrio* for many minutes, and that day after day for a considerable number of days, returned at once to its spasmodic jerkings the moment that the application was suspended. Sometimes it has been obvious that the spasm was subsequently increased by the electricity.

The side to which the twisting occurs has been sometimes the right, sometimes the left. There appears to be no special proclivity to the affection of one side rather than the other in either sex; but when once the malady has shown itself, its pertinacity is remarkable: it remains in exactly the same position, with slight tendency to extend; or it may in rare instances disappear for eight or nine years, and then return to the member that it had previously affected. In many cases *progress* is so slow that no change is observable after several years—*i.e.*, no change as to locality—whereas in others the malady seems to extend either upwards or downwards, and involve muscles not implicated at the first. In this manner the face may be distorted, or the arm may be rendered partially useless by either rigidity or weakness; the head becomes more or less fixed in an oblique position, the ear of one side being drawn down to the shoulder, and the chin thrown upwards and outwards in the opposite direction. When left entirely to itself—*i.e.*, when not interfered with by either the will, the ideas, or emotions of the patients, or by any influence from without—the spasm is tonic, and the head may remain for hours drawn to one side, but motionless. This is rarely, if ever, noticed early in the history of a cure, and sometimes it is never observed; but, even when it occurs after several years' duration of the spasm, the slightest emotional disturbance or attempt at voluntary movement brings back the clonic contraction: and the only difference to be recognized between the early and the later stages of the malady is, that in the latter the head is never brought back to the position of exact equilibrium, and that there is less obvious movement of the head; for, as it seems, the habitual struggle between volition and clonic spasm is given up, and the latter, having gained the day, allows tonic spasm to take its place.

The mental faculties, the sensibility of the skin, the special senses, and the general health undergo no necessary changes in Torticollis. In some highly-marked instances there has been complete integrity of function in every direction; the one thing that has been wrong has been the disease itself. Sometimes the general health has been impaired, the patient has been anæmic and weak; but this has been frequently the result of the annoyance occasioned by the spasm, and very rarely the supposed cause of its development.

Numbness and anæsthesia may occur in the arm, together with œdema, when the scaleni are so much affected as to press upon the brachial plexus and its adjacent veins.[1]

DIAGNOSIS.—The symptoms that have been now described are sufficient when carefully regarded to enable the practitioner to distinguish this disease from every other. An accidental exposure to cold may produce "stiff-neck;" but here the head is permanently fixed in one position, and maintained therein, not by spasmodic rigidity of muscle, but by the fear of pain which, as the patient knows, any movement may occasion. Such malady has its relations to pleurodynia, lumbago, and "muscular rheumatism;" it is sudden in its development, and temporary in its duration, and could only be accidentally mistaken for Torticollis. The opposite error is sometimes made—viz., that of regarding genuine spasmodic Torticollis as a simple "stiff-neck from rheumatism or cold." In its earliest stage, however, genuine Torticollis should be at once distinguished by the clonic character of the spasm, and freedom from pain or movement.

Injuries to the spine occasionally produce stiffness of the neck, and this to such a degree that the head may be permanently placed in some awkward position. In such cases the spasm is tonic; there is marked tenderness of the spinous processes, and with this some fulness or hardness around or behind the vertebral column; and there is also some impairment of the motor or sensory properties in the arms and legs.

In certain *organic diseases of the brain* accompanied by hemiplegia there is sometimes Torticollis, just as there is synergic movement of the eyeballs; but the mode of onset of symptoms is such that a case of cerebral apoplexy cannot well be confounded with the malady now under consideration. The opposite mistake has, however, sometimes been made, and an individual who is beginning to suffer from Torticollis spasmodica has been supposed to be the subject of organic disease of the brain. For the distinction between these two very different conditions it is sufficient to bear in mind that in the one the disease is limited to the neck, in the other it occurs in combination with marked hemiplegia; that in the former the spasm is clonic, in the latter tonic; and that in the first the development of symptoms is insidious, gradual, and local, whereas in the second it is sudden, and of wide distribution.

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[1] Romberg, loc. cit., p. 317.

It is enough to mention the existence of cases in which *growths*, benignant or malignant, may affect the position of the head, in order to prevent the occurrence of any errors in diagnosis.

PATHOLOGY.—Anatomical inquiry has not yet shown the locality or existence of any special lesion of the nervous centres with which Torticollis is necessarily associated. Physiological experiment has proved that it may exist when the spinal accessory nerve is irritated at its passage through the foramen lacerum,[1] or when injury is inflicted on certain muscles, upon the olivary body, or the auditory nerve.[2] The disease would appear to be one of those curious conditions—not yet fully understood—in which some "centre" of associated movements is so altered that there follows a disturbance of the normal equilibrium; a disturbance exhibiting itself at first by dynamic change, but subsequently leading to structural alterations in the affected muscles. It has its analogies in writer's cramp and histrionic spasm, and its peculiar and intimate pathology is a question as yet reserved for further investigation.

PROGNOSIS.—When once established—*i. e.*, when fully developed and of three or four months' duration—Torticollis is one of the most obstinate of maladies. It has sometimes yielded to treatment, under favourable circumstances; but it has almost invariably recurred, and has proved capable of resisting all efforts made for its relief.

Unfortunate as the prognosis is with regard to the cure of this special malady, there is one ground for consolation—viz., that it is not by any means necessary, nor is it at all highly probable, that the victim of Torticollis should suffer from any other nervous disease. Sometimes it forms but part of a general nervous disorder; but, as a rule, it exists alone; and although it may continue for many years, the source of great but measurable annoyance, it does so without entailing any danger to life, or any high probability of ulterior change. Prognosis, therefore, is based upon the duration of the disease, and its complication with other signs of nervous malady. When it exists alone, the patient may look forward to a troublesome and obstinate affection; but he may, at the same time, know its limits, and be directed to go on without fear of further mischief.

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[1] Volkmann, quoted by Romberg, loc. cit., p. 316.

[2] Brown-Séquard, Lectures, p. 194.

TREATMENT.—In its early stages Torticollis has yielded to various plans of treatment; iron, setons, moxæ, rest, mercurials, electricity, and the division of nerves or of muscles, have each been followed by a cure: but in the advanced stages no one, nor any combination, of these modes of treatment has availed to cure, or even to modify the disease.

I have used all kinds of soothing applications, have employed electricity in every form, and have failed to influence the disease when once it has become firmly fixed; but have found that the continuous current has been useful when the malady has existed for a few months only, and have also at that period seen notable advantage from the continued application of morphia by the method of hypodermic injection.

It would seem desirable to enjoin rest; to secure the regulation of the general health; to apply a moderate continuous current to the muscles which exhibit spasm, and a mild induced current to their antagonists; and to inject morphia, hypodermically, for a lengthened period. It is not essential that the morphia should be injected into the neck; it may be introduced into the arm or thigh, or any other convenient locality: but it is important that its use be steadily continued, and that the quantity injected be gradually increased until a definite effect is produced upon the spasm. Beginning with the tenth part of a grain, the quantity may be increased, if necessary, until two, or even three, grains are injected twice daily; and when the patient can bear this amount, the spasm has sometimes yielded. But it often happens that morphia, even by hypodermic administration, cannot be borne, from the fact of its producing nausea, constipation, and an amount of malaise that is greater than the evil it is intended to relieve; and in such cases the Torticollis is positively increased by the injection. Several patients whom I have known with Torticollis have positively refused to continue the injection of morphia from the misery which it has thus occasioned.

Mechanical contrivances have been employed in order to force the head into position; but these, although so managed as to be borne for a short time—*e.g.*, to enable a clergyman to get through a service, or a doctor to visit two or three patients in succession—are often found to be productive of so much annoyance, or even pain, that the patient would rather trust to his own hands or to the "chapter of accidents" in order to get through his work. The most simple, and at the same time most effective, appliance that I have seen for mild cases is that devised by Dr. Hearne, of Southampton; but it has failed to be of service when the disease has been of long duration. Mr. Heather Bigg has constructed several machines which meet the difficulty for short periods of time; but I have not yet seen any apparatus which a patient with confirmed Torticollis could bear habitually.

Division of the nerves has been useless,[1] and division of the sterno-mastoid worse than useless, for it has led to an exaggeration of the spasm in the deeper-seated muscles at the back of the neck, as I had occasion to observe in a well-marked case that came under my notice some years ago.

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[1] Romberg, loc. cit., p. 319.

VIII.

LOCAL ANÆSTHESIÆ.

BY J. WARBURTON BEGBIE, M.D., F.R.C.P.E.

THE term Anæsthesia (α privative, αἴσθησις, sensibility), indicates deprivation or loss of sensibility, and was first employed by the distinguished Cappadocian physician, Aretæus.[1] There exist three abnormal modifications of the function of sensation: *first*, it may be lost; *second*, it may be exalted (hyperæsthesia); *third*, it may be perverted.

By Local Anæsthesia we understand a morbid state of sensibility, in which the normal physiological sensation of a part is abolished entirely, or nearly so.

Since the introduction of ether and chloroform inhalation, for the purpose of destroying pain, it has been customary to describe these valuable agents as anæsthetics, and the condition of insensibility into which the person is thrown by their action as Anæsthesia. With this interesting phenomenon we have at present no concern.

In Local Anæsthesia the want or failure of the due impression must arise from a morbid state of the extremities of nerves, or of an afferent nerve ceasing to convey the impression to the sensorium, or of the sensorium itself.

Thus we are entitled to limit the seat of the morbid influence, because these three organs, or classes of organs, are concerned in the production of such sensation.

With precisely the same signification as Anæsthesia, the expression, paralysis of sensation, or of the nerves of sensation, has been employed. It were better, however, to abandon the use of paralysis in this sense altogether, and to restrict it to the loss of power of motion. The intimate connection of paralysis and Anæsthesia is abundantly conspicuous: the latter is very frequently noticed as an antecedent phenomenon of the former, or they occur simultaneously; and while paralysis lasts Anæsthesia may continue, or sensation may be restored long before the recovery of the power of motion.

The special situations in which Anæsthesia is met with, or may be considered apt to occur, are various. For convenience of illustration the following classification may be made, and to the forms now to be mentioned attention will be very briefly directed: (*a*) Anæsthesia of the skin (cutaneous Anæsthesia). (*b*) Anæsthesia of muscular nerves. (*c*) Anæsthesia of sensorial nerves. (*d*) Anæsthesia of the fifth pair of nerves. (*e*) Anæsthesia of mucous surfaces. (*f*) Anæsthesia of the viscera.

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[1] ἢν δὲ ἀφὴ ἐκλείπη μούνη κοτέ—σπάνιον δὲ τὸ τοιόνδε—ἀναισθησίη μᾶλλον ἢ πάρεσίς κικλήσκεται.—Περὶ Παραλύσεως. Περὶ Αἰτιῶν καὶ Σημείων Χρονιῶν Πάθων. Βίβλιον Πρῶτον.

(*a*) *Anæsthesia of the Cutaneous Nerves.*—The notable and lasting diminution, or the entire loss, of the tactile sense of the skin is what is understood by cutaneous Anæsthesia. It is by a careful examination as to the delicacy of tactile sensibility, and the perception of degrees of temperature, that we are enabled to determine the extent to which Anæsthesia of the surface exists. For the former purpose the mere statements of the patient will not suffice. Besides measuring the degree and determining the precise seat of Anæsthesia by the point of the needle, recourse must be had to the method of experiment suggested by Weber, testing the consciousness of the patient, while blindfolded, to the two points of a pair of compasses placed at different parts upon the skin, or, which is still more satisfactory, employing the delicate little instrument known as the æsthesiometer of Dr. Sieveking. The ready and accurate determination by the patient of degrees of temperature, heat and cold, is impaired or destroyed: it is not uncommon to find hot things styled cold, and cold things hot. In marked instances of cutaneous Anæsthesia the power of resisting the injurious influence of temperature is lost; and not only so, but, owing to a similar defect, superficial sores are readily formed on parts of the body exposed to even a slight degree of pressure. Evidence of the derangement of the circulation is afforded by a change in the color of the affected part; it is apt to become livid or blue in appearance, and extravasations of serum, and even of hæmatin, occur. Distressing sensations are experienced by the patients—chiefly numbness and pricking; also formication.

In alluding to the treatment of cutaneous Anæsthesia, the distinguished German writer on nervous diseases truly observes, "Die Behandlung der Anæsthesia cutanea war bisher eine *oberflächliche*, im wahren Sinne des Wortes;" but while this is to be regretted, we may reasonably anticipate an increase of our knowledge, owing to the much more satisfactory manner in which the causes and seat of disease have of late, and are at the present time, being investigated.

(*b*) *Anæsthesia of Muscular Nerves.*—The loss of the power of motion is usually unassociated with any marked degree of muscular Anæsthesia. On the other hand instances are on record in which a very perfect insensibility to pain has existed in muscles, while the power of moving them has been retained. It is of the utmost importance to distinguish between the loss of tactile sensation (cutaneous Anæsthesia) and the definition of sensation in muscles, for without carefulness in examination these two are capable of being, and in some instances have no doubt been, confounded. Romberg makes the interesting observation, that muscular Anæsthesia, without the loss of or any damage done to tactile power, exists in tabes dorsalis.[1]

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[1] Muskelanästhesie.

(*c*) *Anæsthesia of Sensorial Nerves.*—The nerves of special sense which thus suffer are the optic (Anæsthesia optica), the Auditory (Anæsthesia acoustica), the Olfactory (Anæsthesia olfactoria; Anosmia), and the Gustatory (Anæsthesia gustatoria; Ageustia). To the many interesting affections included under these terms—for example, amblyopia and amaurosis under optic Anæsthesia—it is quite impossible in this brief notice of Local Anæsthesiæ to make any reference, while such important diseases demand a separate and detailed consideration.

(*d*) *Anæsthesia of the Fifth Pair of Nerves* (Facial or Trigeminal Anæsthesia). — Physiological experiments have demonstrated the remarkable effects produced by section of the fifth pair; of these insensibility of the face, eye, nostrils, cavity of the mouth and tongue, is the most conspicuous: while the extent of the Anæsthesia is of course determined by the nervous injury being limited to one or more branches, or, on the other hand, involving the trunk before division. Experimental inquiry, as well as clinical observation, have further shown that when injury or lesion of the nerve exists within the cranium, the resulting phenomena are not such as are included in Anæsthesia merely, but paralysis and impairment or loss of special sense are also induced. Romberg,[1] in directing attention to the different diagnostic symptoms, has indicated certain very important particulars, as follows: (*a*) The more the Anæsthesia is confined to single filaments of the fifth pair, the more peripheral the seat of the cause will be found to be. (*b*) If the loss of sensation affects a portion of the facial surface, together with the corresponding facial cavity, the disease may be assumed to involve the sensory fibres of the fifth pair before they separate to be distributed to their respective destinations; in other words, a main division must be affected before or after its passage through the cranium. (*c*) When the entire sensory tract of the fifth nerve has lost its sensation, and there are at the same time derangements of the nutritive functions in the affected parts, the Gasserian ganglion, or the nerve in its immediate vicinity, is the seat of the disease. (*d*) If the Anæsthesia of the fifth nerve is complicated with disturbed functions of adjoining cerebral nerves, it may be assumed that the cause is seated at the base of the brain. Thus facial Anæsthesia, as a phenomenon of disease, may be in itself a simple, really trivial, affection, or it may be the indication of serious organic disease. In the former case it will be apparently independent and isolated; in the latter, linked with other striking features, its significancy will as little escape observation as its existence.

Facial Anæsthesia in some instances comes on gradually; in others its occurrence is sudden. Neuralgic pain, or a condition of local hyperæsthesia, may precede its development; while facial palsy and facial Anæsthesia are occasionally associated.

(*e* and *f*) *Anæsthesia of Mucous Surface, and of the Viscera.*—The morbid condition in such circumstances must depend on a failure of the sympathetic to conduct the impression to the brain; but, as a general rule, impressions made on the ganglionic nervous system are not thus conveyed and it requires a powerful irritation, or condition of notable hyperæsthesia, in order that a consciousness of their existence should be established. The inquiry into the operation of the organic nervous system is one of very great difficulty, and Romberg has truly remarked in regard to it, "Von vorn herein bekennen wir unsre unbekanntschaft mit diesen Zuständen, die bisher nicht einmal zur Sprache gèkommen sind, und deren Forschung mit grossen Schwierigkeiten verbunden ist."

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[1] Anästhesie des Quintus Lehrbuch der Nervenkrankheiten.

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